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An Econometric Analysis of Determinants of Foreign Direct Investment: A Panel Data Study for Africa

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AN ECONOMETRIC ANALYSIS OF DETERMINANTS OF FOREIGN DIRECT INVESTMENT: A PANEL DATA STUDY FOR AFRICA.

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ABSTRACT

In the last two decades, foreign direct investment has become a major source of investment capital in developing countries. This study evaluates the determinants of foreign direct investment in Africa using fixed effects feasible generalized least squares model for 45 countries covering the period 1990-2003.

The study finds gross domestic product, literacy rate, exchange rate and population size to have positive relationship with foreign direct investment. But, inflation rate and remoteness have negative relationship with foreign direct investment. Finally, central, eastern and western regions have lower foreign direct investment than southern region.

DEDICATION

I dedicate this work to my parents, Verina and Ludovic Baraba and aunt Regina. This dissertation exists because of their love and support.

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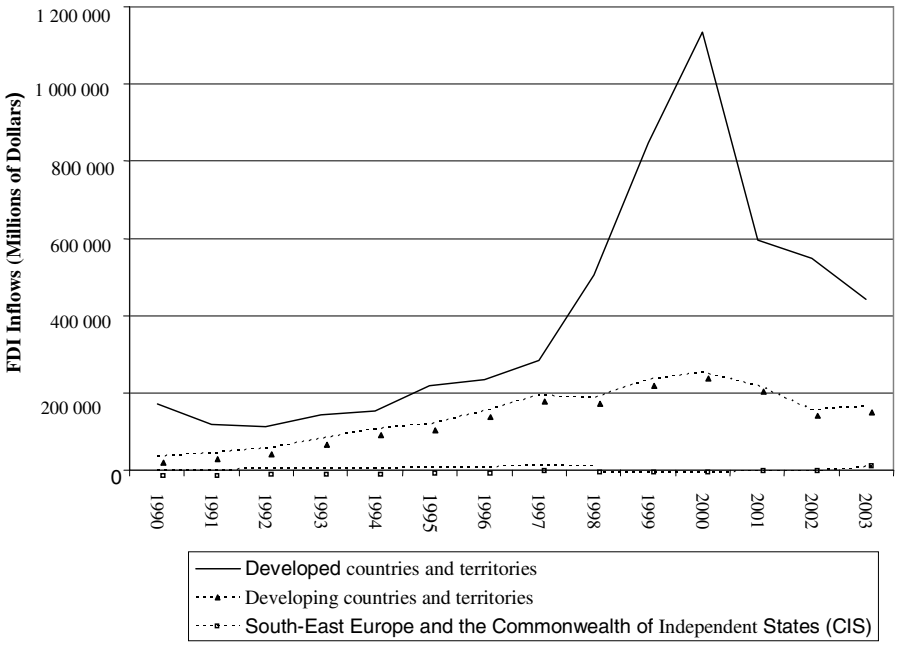
CHAPTER ONE
INTRODUCTION

Many African countries have adopted export-led growth policies, but most face investment funds constraints and are seeking foreign direct investment. Foreign direct investment is a major source of private capital and has significantly increased in Africa over the past two decades due to policy reforms and economic liberalization.

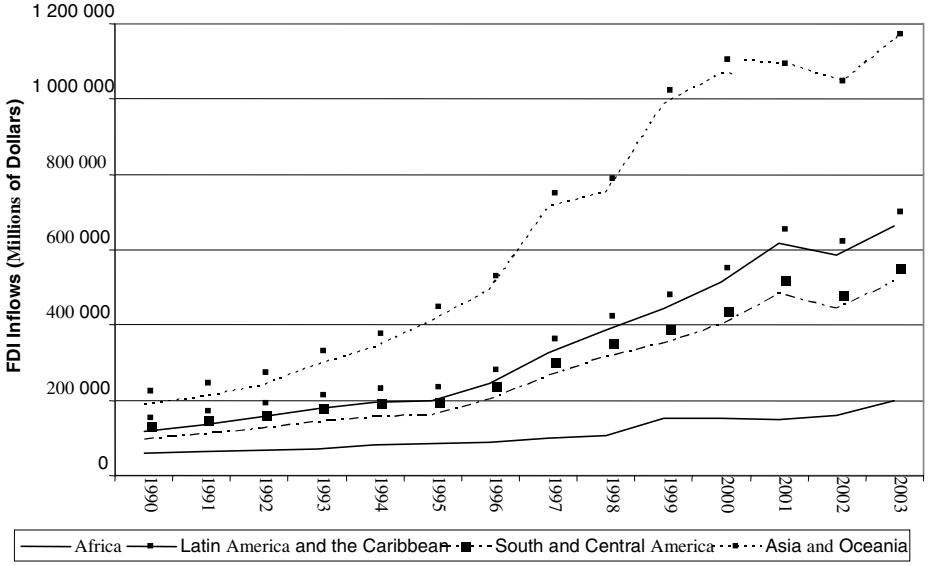
According to the United Nations, global foreign direct investment has rebounded from the declines of 2001-2003 to about $648 billion in 2004, which was 2% higher than for 2003 (UNCTAD, 2005). Recent foreign direct investments in developing countries have increased to their highest levels since 1997 reaching $233 billion which is 36% of the world total (UNCTAD, 2005; Chantal and Osakwe, 2005).



Source: UNCTAD, 2005.

Fig. 1: FDI Inflows for World Host Regions 1990-2003

Most of the increase in foreign direct investment in Africa is being driven by high price of minerals such as copper, diamonds, gold and platinum and particularly oil with levels hitting $18 billion in 2004 after an increase of 38% from 2003, but still accounting for only 3% of world total (UNCTAD, 2005).



Source: UNCTAD, 2005.

Fig. 2: Foreign Direct Investment Inflows for Developing Countries Constituent Regions 1990-2003

Investments in natural resources still dominate foreign direct investment to Africa with most of it going into minerals which accounted for 63% of all foreign direct investment in 2004 (UNCTAD, 2005). But since 1999, there has been an increase in inflows into tertiary (service) sector, in 1999, attracting more inflows (US$3,1Billion) than the primary sector (US $2,726 Billion) (Chantal and Osakwe, 2005).

Objective of the study

The objective of this study is to evaluate the determinants and regional distribution of foreign direct investment in Africa.

Significance and scope of the study

Although much empirical work on foreign direct investment has been done elsewhere, there is a lack of research on foreign direct investment in Africa. The only studies on determinants of foreign direct investment in Africa are by Aseidu (2002, 2003), but the studies are limited to Sub-Saharan Africa and are not specifically focused on home country determinants. Other studies that attempt to study foreign direct investment in Africa combine African countries with other developing countries.

Most of the studies on foreign direct investment used cross-section data and those that used panel data apparently did not address the problems of heteroscedasticity and autocorrelation, and estimated random effects and fixed effects models without correcting for these two problems which certainly plague inter-country data. Moreover, most of these studies apparently did not carry out specification tests to justify the panel data estimation methods used. This study addressed these two concerns by carrying out specification tests to justify the use of the fixed effects model and feasible generalized least squares estimation method.

This study covers the period 1990-2003 and this was because of data availability which is a major problem in most of foreign direct investment studies mainly in Africa. But the period was also one in which most African countries began to receive significant levels of foreign direct investment after the wave of liberalization that swept Africa in the late 1980s up to the mid 1990s.

Limiting the study to Africa was justified on two grounds; first, as some studies and investigators have noted, factors which attract foreign direct investment to Africa are different from factors that attract it to other regions (Aseidu, 2002). Secondly, Africa is

unique and what works elsewhere may not work in Africa. Therefore, studies that are done elsewhere are not usually representative of the African situation and therefore addressing Africa alone will make the results more appropriate. The choice of the countries was to try as much as possible to use all African countries for which data were available for the period chosen and since there was an interest in regional comparison there was a deliberate attempt to balance the countries from each of the regions of Africa.

Organization of the study

The rest of the dissertation is organized as follows; Chapter 2 presents theoretical and empirical literature on the determinants of foreign direct investment. The econometric model, hypotheses, definition of variables and data descriptions is presented in chapter 3. Chapter 4 presents estimation results, analysis, discussion, and policy recommendations.

CHAPTER 2
LITERATURE REVIEW

Introduction

There is an extensive literature on foreign direct investment based on perfect and imperfect market theories, starting with the pioneering work of Stephen Hymer (1960) to the new trade theory popularized by Markusen (1984). Perfect market theories include differential rates of return theory (McConnel, 1980), portfolio diversification theory (Calvet, 1980), and currency differential theory (Froot and Stein, 1991). Imperfect market theories include ownership specific advantage theories (McConnel, 1980), locational specific advantage theory (Gattai, 2005), internalization theory (Dunning, 1995), government-investor bargaining theory (Blomstro and Kokko, 2003) and the eclectic paradigm (Dunning, 1995).

The eclectic paradigm integrates ownership specific advantage theory, the location specific advantage theory and internalization theory. Models based on extensions of the eclectic paradigm include the new trade theory models that consist of the horizontal foreign direct investment model (Markusen, 1984), vertical foreign direct investment model (Markusen, 1984) and the knowledge-capital model (Markusen and Maskus, 2001a).

The following sections contain detailed discussions of perfect market and imperfect market theories of foreign direct investment. The section ends with a review of empirical studies of foreign direct investment in Africa.

Perfect market theories

These theories are based on the assumptions that markets are perfectly competitive and goods but not the factors of production are internationally mobile so that production can only take place in a country endowed with factors of production.

Differential rates of return theory is based on the concept of competitive profit maximization which states that firms seek to maximize the discounted sum of present and future net cash flows from their investments by minimizing costs (McConnel, 1980).

According to the theory, a firm develops an investment policy based on product prices, factor prices and tax rates with the aim of reaping the highest rates of return from its investments (McConnel, 1980). Because of the return maximization motive, capital moves from country A that offers lower long-term return on capital to country B where returns are higher and similarly companies based in country A make direct investments in country B because the yield on their assets is higher in the foreign country (McConnel, 1980).

The earliest work on these lines was by Heckscher and Ohlin in their factor–proportions model which states that factor-endowment differences between countries, combined with trade costs or specialization means that factors prices cannot be equalized internationally. Consequently, capital flows from capital abundant to capital scarce countries implying that foreign direct investment does not take place between identical countries (Markusen and Maskus, 2001a).

This theory has been challenged empirically on grounds that it fails to explain instances when firms in country A invest in country B even though the rates were higher

in country A, or where cross investment of the same industry categories have occurred simultaneously between two countries (McConnel, 1980).

Portfolio diversification theory (Calvet, 1980), integrates return maximization and risk reduction motives and postulates that when a firm is in position to choose among alternative investment projects, the determining factors include rates of return and opportunities to reduce risk through diversification. A firm may reduce risk by undertaking projects in more than one country since the returns on activities in different countries are likely to be less than perfectly correlated.

The currency differential theory (Froot and Stein, 1991) states that international direct investment flows tend to move out of countries with relatively stronger currencies to those with weaker currencies. This is attributable to information imperfection in the market that may lead to a real depreciation of the domestic currency which effectively lowers the wealth of foreign residents. As a result of the relative wealth and low input cost, foreign investors find it profitable to invest in the country with a depreciated currency (Froot and Stein, 1991).

Imperfect market theories

Imperfect market theories arose out of the limiting assumptions about perfect markets and the immobility of factors of production. Hymer's dissertation was the first to recognize the limitations arguing that imperfect competition was the main motivation for foreign direct investment. According to Hymer, since local firms have better information about the economic environment in their country than foreign firms, two conditions must be fulfilled for foreign direct investment to take place: (1) foreign firms must posses a

countervailing advantage over local firms to make such investment viable and (2) the market for this advantage must be imperfect. Hymer's work motivated studies on foreign direct investment based on market imperfections resulting from market disequilibrium, government imposed distortions, market structure imperfections and market failure.

Ownership specific advantages

Ownership specific advantages refer to unique characteristics that enhance relative competitiveness of firms. Ownership advantage theories include monopoly advantage theory (Calvet, 1980), oligopoly advantage theory (Calvet, 1980) and international product life cycle theory (McConnel, 1980).

The monopoly advantage theory postulates that firms that can exploit technological lead, superior capacity of scanning the international environment or the ability to take advantage of economies of scale can operate subsidiaries abroad more profitably than local competing firms (McConell, 1980).

This theory has empirical support in the literature but has been criticized for not offering explanations for cases where firms with apparent monopoly advantages, like the aircraft industry, have relatively low foreign direct investment (McConnel, 1980).

Oligopoly advantage theory also called the follow-the leader theory asserts that rival firms in oligopolistic industries counter each other's moves by making similar moves themselves, the so called oligopolistic reaction or the band wagon effect (McConnel, 1980). Empirical study by Knickerbocker (1973) found evidence of "bunching effect" or entry concentration of foreign firms belonging to the same oligopolistic industry as well

as a positive association between concentration and industry entry and a negative association with product diversity.

International product life cycle theory (Vernon, 1966) is a temporal extension of the monopoly advantage theory to explain why a manufacturing firm shifts from exporting, to foreign direct investment. The assumption is that in the early stages of the investment cycle, before production has been standardized, a firm may gain monopoly advantage which subsequently erodes as independent foreign firms imitate the product and intensify competition in the foreign country to which it is exporting (McConnel, 1980). And in order to maintain profitability, the firm may have to reduce costs by investing in production facilities abroad so as to capture rent from product development (Calvet, 1981).

The theory has empirical support and has been credited for explaining the large increase in foreign direct investment from USA to Western Europe after the Second World War. However, it has been criticized for being limited to initial entry of a firm into an area without explaining foreign direct investment of established firms with international production and marketing system (McConnel, 1980).
Furthermore, it addresses market seeking foreign direct investment exclusively (Dunning, 1993).

Other criticisms of the theory are based on its failure to explain a common phenomenon in foreign direct investment where a new product is simultaneously introduced to the domestic and foreign markets, and the other is that it seems to be concerned with the firm's product performance but not the dynamics of the firms growth process (McConnel, 1980).

Location-specific advantages theory

According to this theory, locational advantages are said to arise when it is more profitable for a firm to produce abroad rather than producing at home and exporting abroad (Gattai, 2005). Incentives for a firm to produce abroad may include availability of relatively inexpensive inputs, high demand, economic policies, lower tax rates, efficient infrastructure, political stability and potential for expansion.

Internalization theory

According to this theory, firms can reduce their transactions cost by forward and backward integration across borders through mergers, acquisitions or establishment of new plants. Internalization and foreign direct investment are expected to occur when net benefits of joint ownership across international borders exceed the net benefits of external trading relationships. Moreover, internalization of intermediate production process reduces uncertainty by circumventing market imperfections (Singh and Jun, 1995).

The Eclectic paradigm

The eclectic paradigm is an integration of ownership advantage, locational advantage, and internalization theories. Because of limitations of ownership advantage, locational advantage and internalization theories in explaining foreign direct investment behavior of multinationals, the eclectic paradigm integrates elements from each of the three theories into what is called the OLI[1] frame work.

The OLI framework suggests that for international production to take place (1) the firm must hold product related ownership advantage over foreign firms in their home

[1] Ownership advantages (O), Locational advantages (L), Internalization (I)

country. Product advantages include patents, blue print and trade secrets, and confers market power or cost advantage which outweigh disadvantages of doing businesses abroad (2) the foreign market must offer a locational advantage that makes it profitable to produce in the foreign market, and (3) it must be more advantageous for the firm to retain these advantages internationally by direct extension of its activities than to retain them externally, through licensing foreign producers (Hanink, 1985).

The paradigm proposes that foreign direct investment and the growth of multinational corporations can be explained by the extent and nature of ownership-specific advantages of the firm, the extent and nature of location bound endowments, and the extent to which markets for these advantages are internalized by the firm. Accordingly, it is the configuration of these advantages that determine a firm's international production and growth (Singh and Kundu, 2002).

If the firm cannot gain from internalization, it will choose to license its ownership advantages to other firms and in the absence of locational advantages will favor home expansion. It will invest abroad when locational and internalization benefits exist.

The eclectic paradigm is a framework that points to methodology and a generic set of variables to explain foreign direct investment (Dunning, 2001). It does not emphasize the key determinant of foreign direct investment but lays a foundation for the organization of the analysis specifying the level (firm, industry or country) of analysis and questions to address.

New trade theory models

New trade theory models have been developed from the eclectic paradigm. These are firm level models that explain different types of foreign direct investment by multinational firms and consist of horizontal foreign direct investment model (proximity concentration), vertical direct investment model (the factor proportions hypotheses) and the Knowledge–Capital model.

The horizontal foreign direct investment model, first proposed by Murkesen(1984), is based on the assumption that firm-level scale economies reduce fixed costs of two-plant firms compared to one-plant firms and drive foreign direct investment (Markusen and Maskus, 2001b).

Horizontal foreign direct investment occurs when a firm has identical plants in multiple countries producing the same or similar product. The theory predicts that given moderate to high trade costs and scale economies, multinational activity will arise in search of markets between similar countries. Extensions of this model include proximity-concentration hypotheses models (Hortsmann and Markusen, 1987, 1992; Brainard, 1993).

The vertical foreign direct investment model uses elements of the OLI framework to explain resource seeking foreign direct investment behavior. Vertical firms refer to single plant firms that fragment production process into stages based on factor intensities and locate activities in several countries according to international differences in factor prices (Markusen and Maskus, 2001b).

According to this model, if two countries have similar factor endowments, production in multiple countries will not arise; the world equilibrium will be achieved through trade.

But when there is a significant difference in factor endowments between countries, the world equilibrium can be established through trade or foreign direct investment.

Foreign direct investment allows trade in products rather than reallocation of the factors and since this implies location of production and headquarters in different countries, the process is referred to as vertical foreign direct investment (Davis, 2005 and Markusen and Maskus, 2001b).

The Knowledge–Capital model is the latest of the new trade theory models which combines the horizontal and vertical models of foreign direct investment. Key assumptions of the Knowledge-Capital model are (1) services of knowledge based and knowledge generating activities such as R&D, and plant production can be geographically separated and implemented at low cost (2) knowledge intensive activities are skilled labor intensive relative to production, and (3) knowledge based services have a joint-input characteristic in that they can be utilized simultaneously by multiple facilities (Davis, 2005 and Markusen and Maskus, 2001b).Accordingly these assumptions explain horizontal and vertical multinationals.

Knowledge-Capital model predicts that both horizontal and vertical multinationals can arise depending on such differences between countries as size, endowment, trade costs and investment costs (Markusen and Maskus, 2001b).

Government-investor bargaining models

Game theoretic models have been used to explain foreign direct investment as a bargaining process between governments and investors in which governments offer incentives to attract foreign direct investment. Most of the recent work on foreign direct

investment has concentrated on the OLI framework and its applications to the flow of foreign direct investment multinationals activity.

The view has been that multinationals are attracted by economic fundamentals in the host country, most important of which are market size, level of income, skill levels, availability of infrastructure, trade policies, political and macroeconomic stability (Blomstrom and Kokko, 2003).

Nevertheless, multinational firms establishing plants overseas are often offered substantial incentives including reduced tax rates in the early years of operation, cash grants, subsidized loans and labor training grants (Bond and Samuelson, 1986). Until recently, such incentives were seen as minor determinants of foreign direct investment, yet they might tilt the investment decision in favor of one of several similar target countries (Blomstrom and Kokko, 2003).

However, the views on the importance of incentives have begun to change in recent years and are considered a more important determinant of foreign direct investment than previously thought. This is indicated by the proliferation of investment incentives across the world (Bond and Samuelson, 1986; Blomstro and Kokko, 2003). With the exception of export processing zones and industrial parks where infrastructure and land are subsidized, developing countries are more likely to base their incentives schemes on tax holiday and other fiscal measures (Blomstrom and Kokko, 2003).

One of the factors that have allowed developing countries in Africa to take part in the incentive game is the liberalization of the world economy which has allowed firms to export to their affiliates or foreign customers. This has reduced the need for firms to rely

on the host country market and allowed small countries to compete for investments that would have gone to bigger markets (Blomstrom and Kokko, 2003).

With competition for investment in the world, incentives have become an important element in the attraction of foreign direct investment and are now being integrated into foreign direct investment theory using game-theoretical models (Bond and Samuelson, 1986, Haaland and Wooton, 2000, Bjorvatn and Eckel, 2006, Ma, 2005, Barros and Cabral, 2000 and Black and Hoyt, 1989). The contemporary view is that an enabling investment environment or resource endowments may not attract investment without active government involvement in attracting investors. Therefore policy incentives are gaining importance as some of the most important determinants of foreign direct investment.

Empirical studies

Previous empirical studies of foreign direct investment in Africa have covered investor and host country influences on foreign direct investment along two lines: investors' perceptions of investment in the host country and the institutional environment in the host country, respectively. Investors' perceptions were about expectations of economic gains under prevailing conditions in the host country. And the major elements of the host country institutional environment included governance, economic environment, labor markets, financial, demographic factors, natural resources as well as risks and uncertainties.

Past studies have reported evidence of adverse effects on foreign direct investment in Africa due to negative investors' perceptions of investment opportunities in the host

country attributable to bureaucratic impediments (Kolstad and Villanger, 2004a), administrative barriers (Mosima, 2003), political risk of long term security of investments (Mosima, 2003; Akinkubge, 2003; Kolstad and Villanger, 2004a; Morisset, 2000; Aseidu, 2003), and uncertain future returns (Morisset, 2000; Nonnermberg and Mendoca, 2004).

Similarly, institutional elements that have impeded foreign direct investment in Africa were political instability, corruption, democracy, limited government commitment and openness to free trade, privatization, deficit government public expenditure, and restrictive regulation on foreign direct investment (Aseidu, 2003; Adugna, *et al.*, 2001; Loree and Guising, 1995; Bhattacharya, *et al.*, 1995).

Four host country factors with positive effects on foreign direct investments in Africa have been reported and these include democratization (Kolstad and Villanger, 2004a), trade and monetary policy liberalization (Addison and Heshmati, 2003; Akinkubge, 2003; Bende-Nabende, 2002), privatization (Mosima, 2003; Bhattacharya, *et al.*, 1995) and justice (Obwona, 2001).

Other determinants of foreign direct investment in Africa included the status of the domestic economy, exchange rate, labor markets, natural resources, infrastructure, cultural homogeneity and cultural distance.

Studies on the status of the domestic economy and foreign direct investments indicate positive effects of domestic market size (Akinkugbe, 2003; Addison and Heshmati, 2003; Loree and Guising, 1995), efficient resources utilization (Obwona, 2001; Morisset, 2000), rates of return to investments (Obwona, 2001; Nonnermberg and Mendoca, 2004; Todd, *et al.*, 2004) on foreign direct investment.

The exchange rate has influences on foreign direct investments through responses in the goods and money markets to unanticipated changes (Bouoiyour, 2003; Ioannatos, 2004; Nonnermberg and Mendoca, 2004; Bhattacharya, *et al.*, 1995).

The labor market attributes especially wages and labor productivity affected foreign direct investments through production costs, profitability levels and competitiveness (Bouoiyour, 2003; Ioannatos, 2004; Todd, *et al.*, 2004). And natural resources, especially availability of extractable minerals and petroleum deposits were major determinants of foreign direct investments through attraction to resource seeking foreign direct investment (Aseiedu, 2002).

Finally, other studies reported influences on foreign direct investment attributable to size of the service sector (Ioannatos, 2004), risk and uncertainty (Adugna, *et al.*, 2001; Mosima, 2003; Akinkugbe, 2003; Kolstad and Villanger, 2004a; Morriset, 2000; Aseidu, 2003; Nonnermberg and Mendoca, 2004), infrastructure and amenities including health and school facilities and quality (Aseidu, 2003; Ioannatos, 2004; Nonnermberg and Mendoca, 2004; Akinkugbe, 2003), and cultural homogeneity and cultural distance of the host country from the source of the investment (Loree and Guising, 1995).

CHAPTER THREE
FOREIGN DIRECT INVESTMENT IN AFRICA: BACKGROUND AND THE ECONOMETRIC MODEL

Background

This study explains foreign direct investment in terms of the level and growth rate of gross domestic product, capital formation, percentage of paved roads, inflation rate, literacy rate, trade (imports and exports), geographical location and political stability using annual time series data for forty six African countries. The choice of the explanatory variable is based on theory and conventional practices in the foreign direct investment studies.

The explanatory variables cover the key dimensions of the determinants of direct foreign investment which consist of market size, infrastructure, economic environment, labor market, economic policy, international economic relationships and political stability. The data are from several sources including the World Bank Development Indicators, 2005, The Freedom House, and *Centre d'Etudes Prospectives et d'Informations Internationales* (The French Institute for Research on International Economy).

Table 1 shows the mean foreign direct investment during the sample period (1990-2003) by country and region. The top five foreign direct investment destinations during the sample period were Nigeria ($1,553 million), South Africa ($1,261 million), Angola ($995.7 million), Morocco ($ 787.1 million) and Egypt ($762 million). And the lowest five foreign direct investment destination were Gabon ($-86.8 millions), Cameroon ($-7.3

million), Burundi ($1.3 million), Central African Republic ($1.6 million), Guinea-Bissau ($3 million).

Table 1: Mean Annual Foreign Direct Investments in Africa, 1990-2003

Country/ Region	Mean ($m.)	Country/ Region	Mean ($m.)
Central Region	183.3	Southern	211.1
Angola	995.7	Botswana	7
Burundi	1.3	Lesotho	25.7
Central African Republic	1.6	Malawi	13.4
Congo, Democratic Republic	29.5	Mauritius	49.5
Congo Republic	134.0	Mozambique	142.9
Côte d' Ivoire	208.1	Namibia	126.1
Gabon	-86.8	South Africa	1261.1
		Zambia	133.3
		Zimbabwe	72.0
Eastern Region	71.2		
Djibouti	3.2		
Eritrea	48.9		
Ethiopia	135.5	Western Region	140.1
Kenya	40.4 1	Benin	38.9
Madagascar	27.3	Burkina Faso	10.5
Rwanda	4.5 1	Cameroon	-7.3
Tanzania	211.2	Gambia	23.4
Uganda	98.8 5	Ghana	105.2
		Guinea	23.0 6
Northern Region	405.5	Guinea-Bissau	2.8 57
Algeria	358.6	Liberia	53.7
Chad	173.8	Mali	58.7
Egypt	762.4	Niger	12.8
Libya	7.7	Nigeria	1552.8
Morocco	787.0	Senegal	56.6
Sudan	281.9	Sierra Leone	6.2 78
Tunisia	467.2	Togo	23.7

Table 2 shows country and regional shares of foreign direct investment during the sample period (1990-2003).

Table 2: Mean Annual Foreign Direct Investments Shares in Africa, 1990-2003

Country/ Region	Share (%)	Country/ Region	Share (%)
Central Region	15	Southern Region	22
Angola	12	Botswana	1
Burundi	0	Lesotho	0
Central African Republic	0	Malawi	0
Congo Democratic Republic	0	Mauritius	1
Congo, Republic	2	Mozambique	2
Côte d' Ivoire	2	Namibia	1
Gabon	0	South Africa	15
		Zambia	2
		Zimbabwe	1
Eastern Region	7		
Djibouti	0		
Eritrea	1		
Ethiopia	2	Western Region	23
Kenya	0	Benin	0
Madagascar	0	Burkina Faso	0
Rwanda	0	Cameroon	0
Tanzania	2	Gambia	0
Uganda	1	Ghana	1
		Guinea	0
Northern Region	33	Guinea-Bissau	0
Algeria	4	Liberia	1
Chad	2	Mali	1
Egypt	9	Niger	0
Libya	0	Nigeria	18
Morocco	9	Senegal	1
Sudan	3	Sierra Leone	0
Tunisia	5	Togo	0

Note. Zero percentage denotes shares under 1%.

The top six out of the forty five countries had seventy percent of total African foreign direct investments. These were Nigeria (18%), South Africa (15%), Angola (12%), Morocco (9%), Egypt (9%) and Tunisia (5%).

The mean annual foreign direct investments in Africa (Fig.3) is characterized by a period of relatively slow and steady growth (1990-1996) followed by a period of higher and more variable growth (1997-2003). The mean foreign direct investment in Africa increased from $63 million in 1990 to $363 million in 2003.

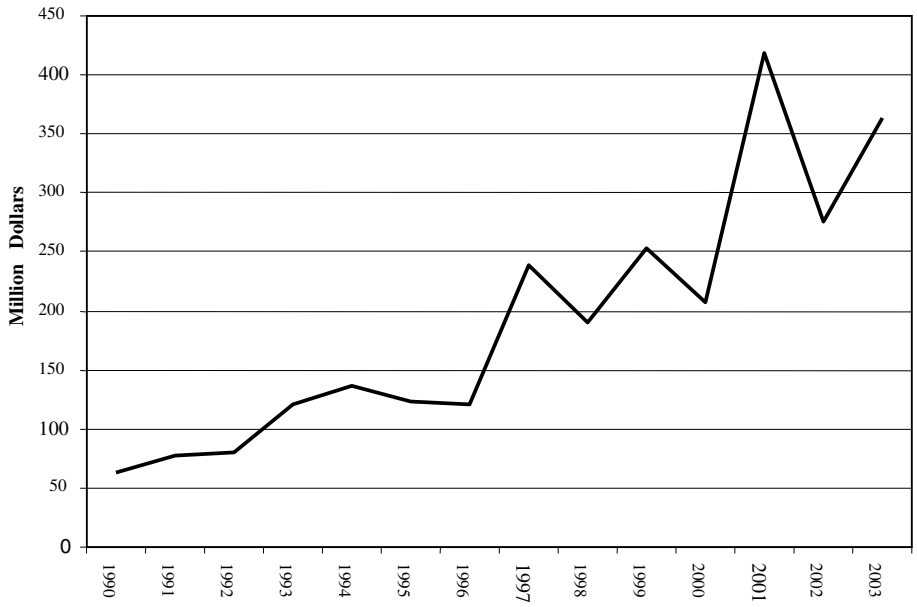


Fig. 3. Mean Annual Foreign Direct Investments in Africa: 1990-2003

Foreign direct investment index and trend (Fig. 4) shows a steady growth with greater annual variations from 1993 through 2003.

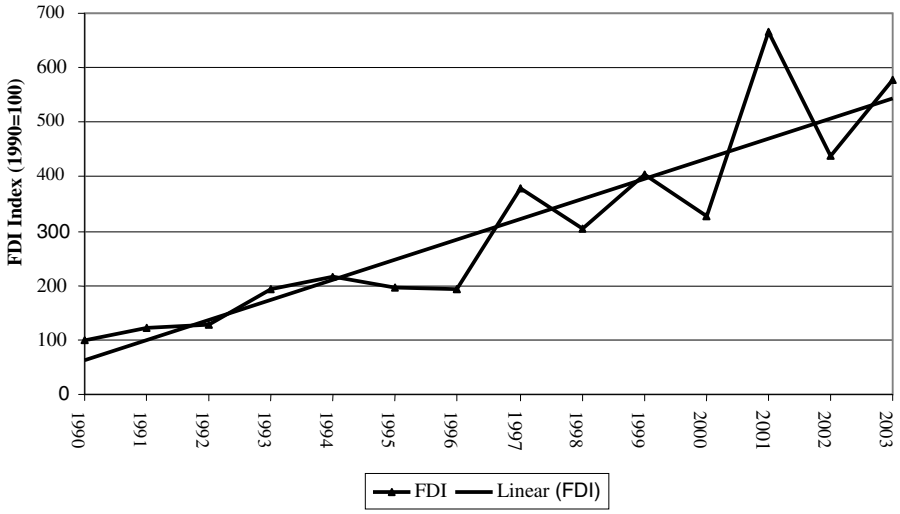


Fig. 4. Foreign Direct Investment Index and Trend

Regional foreign direct investment in Africa (Fig. 5) was characterized by higher levels in the northern and southern regions and lower levels in the eastern and central regions.

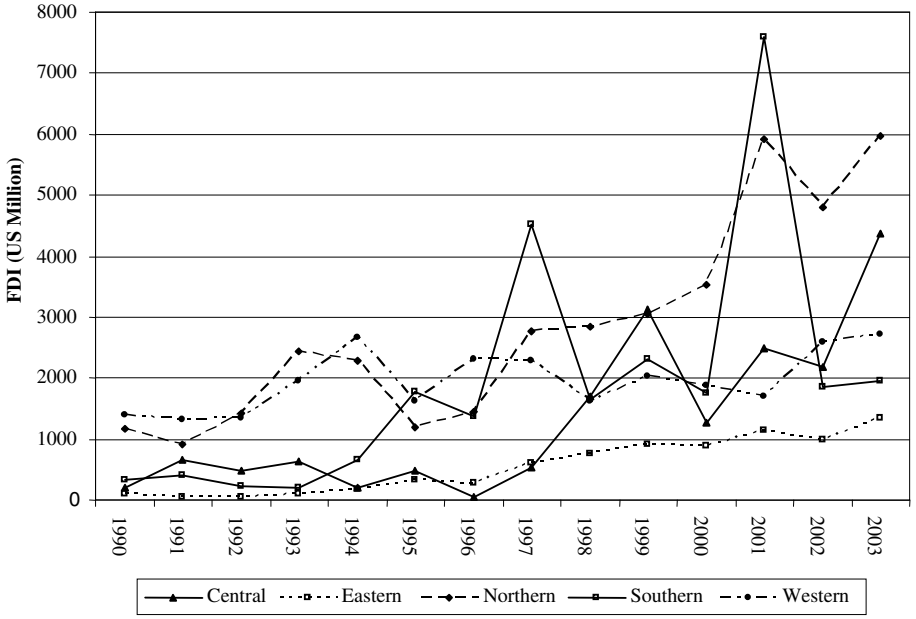


Fig. 5. Regional Foreign Direct Investment in Africa, 1990-2003

Regional foreign direct investment index (Fig. 6) shows relatively high annual growth rates in the eastern and southern regions, and relatively low growth rates in the northern and western regions.

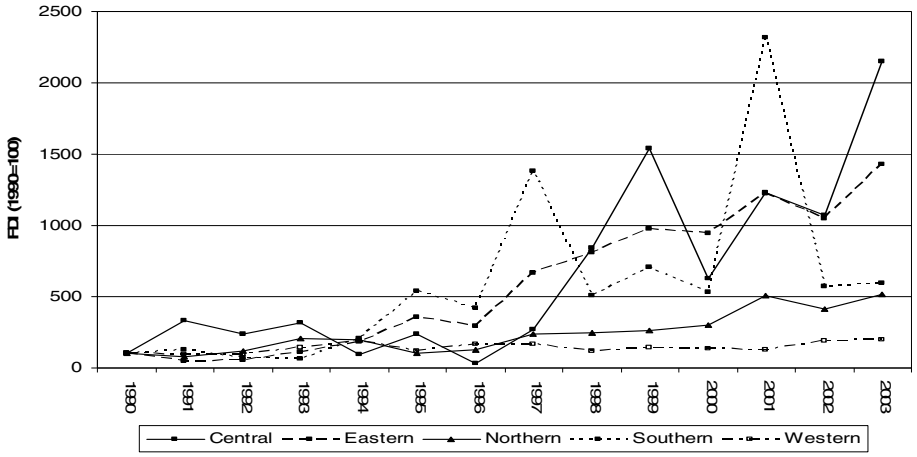


Fig. 6. Regional Foreign Direct Investment Index, Africa: 1990-2003.

There was regional concentration of foreign direct investment (Fig. 7) where northern region had 33% of total foreign direct investment in Africa during the sample period and each of the other regions had under 25% share: southern region (22%), western region (23%) central region (15%) and eastern region (7%).

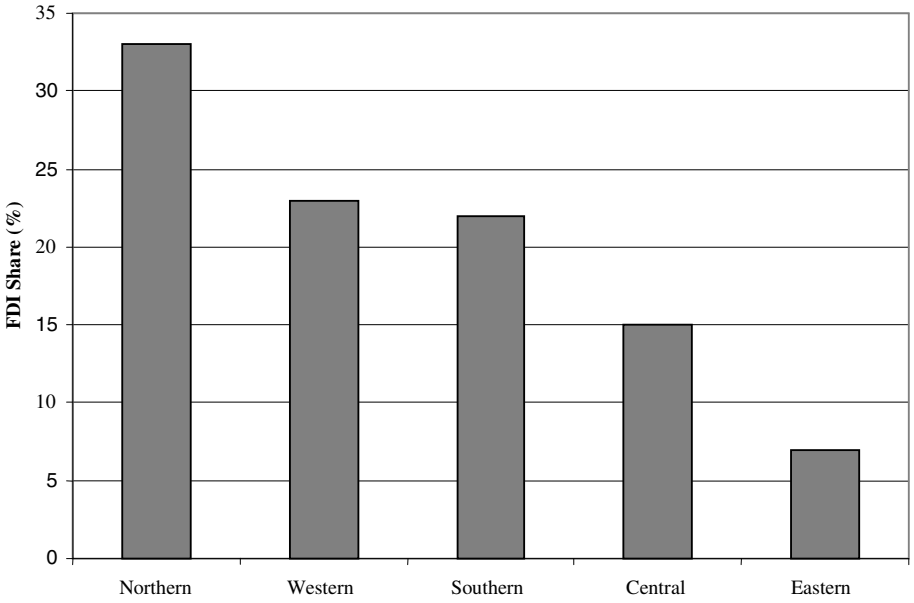


Fig. 7. Regional Distribution of Foreign Direct Investment in Africa, 1990-2003

The northern region had much higher foreign direct investment level and growth rate up to 1994 and maintained this dominance but with convergence to the levels and growth rates in the other regions (Fig. 8).

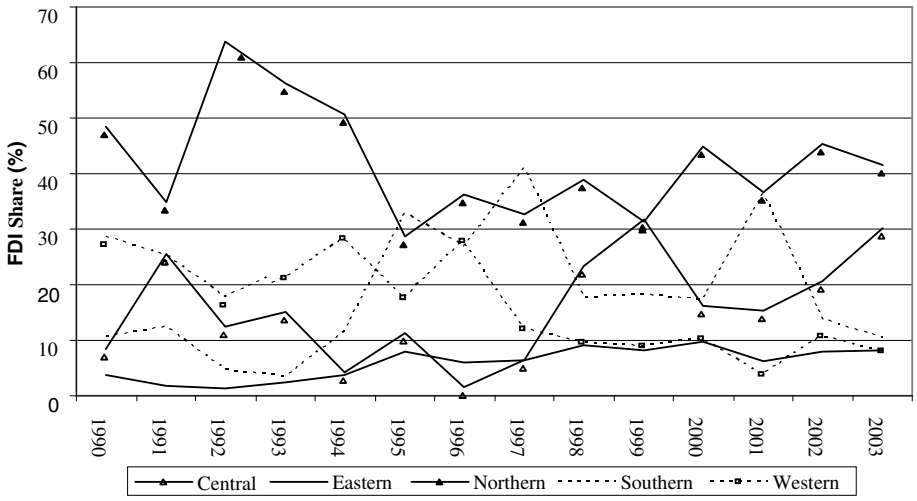


Fig. 8. Mean Annual Share of Foreign Direct Investment in Africa by Region, 1990-2003

The sample mean annual values of the explanatory variables which include gross domestic product, capital formation, inflation rate, literacy rate, exchange rate, remoteness, percentage paved road, openness, and political stability are presented in table 3.

Table 3: Mean Annual Values of Selected Variables

Year	Gross Domestic Product ($Mil)	Capital Formation (%)	Inflation rate (%)	Literacy rate (%)	Exchange Rate (#)	Remoteness (#)	Paved Road (%)	Openness (#)	Political Stability (#)
1990	738.5	20.2	19.8	50.1	178.7	1349.8	25.2	61.3	5.2
1991	740.9	19.2	75.0	51.1	216.6	1369.5	25.2	60.1	4.9
1992	711.4	18.9	131.8	52.1	261.6	1371.4	25.2	62.0	4.8
1993	695.8	18.8	100.4	53.2	318.3	1411.3	24.4	62.5	4.9
1994	697.0	19.6	626.0	54.2	476.5	1435.2	24.7	70.0	4.9
1995	707.1	19.2	101.4	55.3	574.9	1418.5	25.8	68.3	4.7
1996	727.9	19.6	130.5	56.2	654.2	1399.8	24.7	66.6	4.7
1997	742.7	18.8	14.1	58.6	724.3	1396.3	25.9	66.4	4.8
1998	753.5	20.0	11.4	59.7	785.1	1393.1	25.8	66.9	4.6
1999	754.7	19.3	20.2	60.7	873.2	1421.4	25.5	66.6	4.6
2000	764.6	19.0	27.6	62.0	1070.6	1430.9	37.7	69.0	4.6
2001	779.7	19.9	20.0	64.0	1259.3	1421.5	36.9	68.9	4.6
2002	789.9	20.0	12.5	64.2	1368.4	1413.3	34.7	69.2	4.5
2003	813.7	20.8	8.3	64.2	1410.2	1385.2	34.7	69.5	4.4

Gross Domestic Product

The annual mean gross domestic product increased from $738.5 million in 1990 to $813.7 million in 2003 and grew consistently except between 1991 and 1994 when it decreased from $711.4 million to $697.0 million (Fig 9, Table 3). The drop in 1992 was mainly due to the low GDP levels for Liberia, Democratic Republic of Congo and Sierra Leone which were going through wars whose GDPs contracted by -36.4736%, -13.4562% and -20.903% respectively and the contraction of Guinea-Bissau GDP (-30.0254 %) which was responsible for the drop in the 1998.

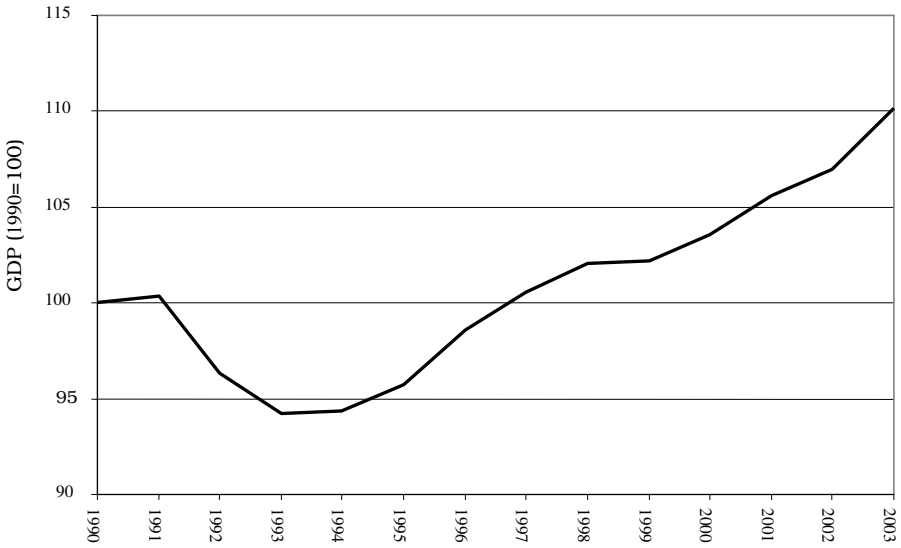


Fig. 9. Annual Mean Gross Domestic Product, Africa: 1990-2003.

During the sample period, the lowest annual mean gross domestic product was in the western region and the highest, for most of the years, was in the

southern region, and in between were northern, central, and eastern regions, in that order (Fig. 10).

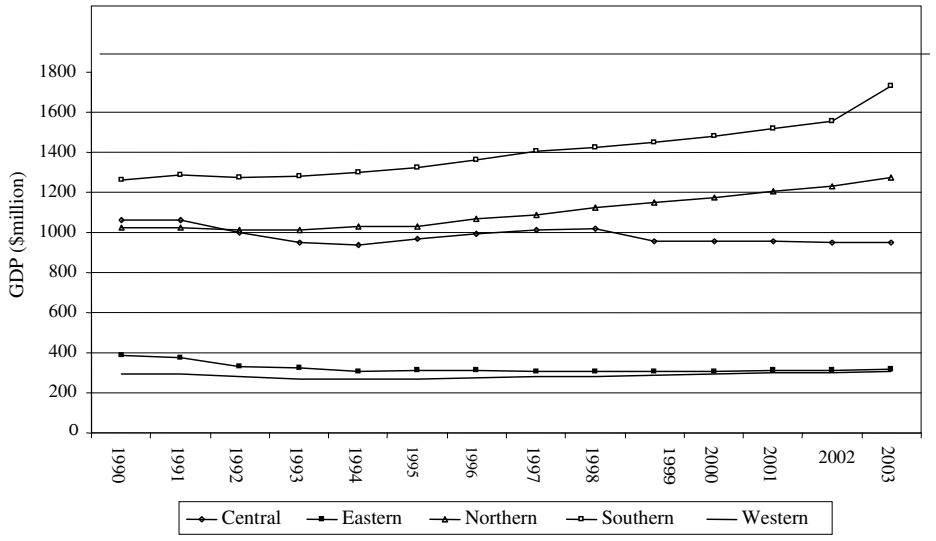


Fig. 10. Annual Mean Regional Gross Domestic Product, African Regions: 1990-2003.

Mean annual gross domestic product for all the regions except northern and southern regions was below the base period for all the years in the sample period. The annual mean gross domestic product for the northern region increased through out the sample period. The annual mean gross domestic product for the southern region increased for every year except the period 1990-1995 when it was almost constant (Fig. 11).

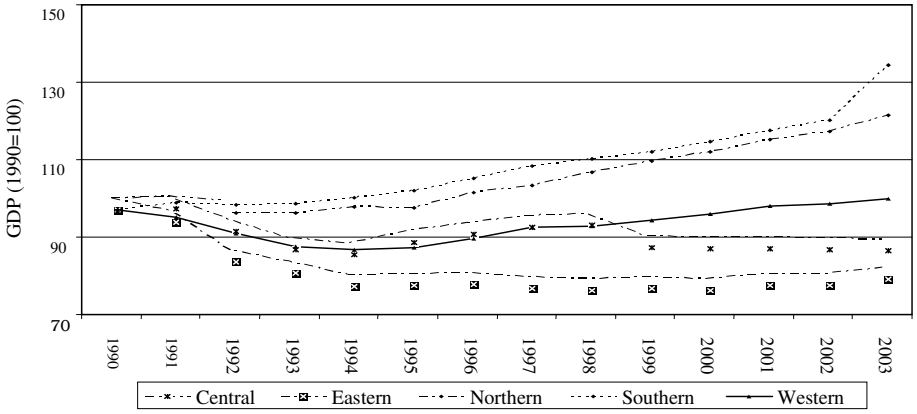


Fig. 11. Annual Mean Regional Gross Domestic Product Index, African Regions: 1990-2003.

Capital Formation

The annual mean gross capital formation as a percentage of GDP fluctuated through out the sample period, ranging from 20.2% in 1990 to 20.8% in 2003 (Fig.12, Table 3).

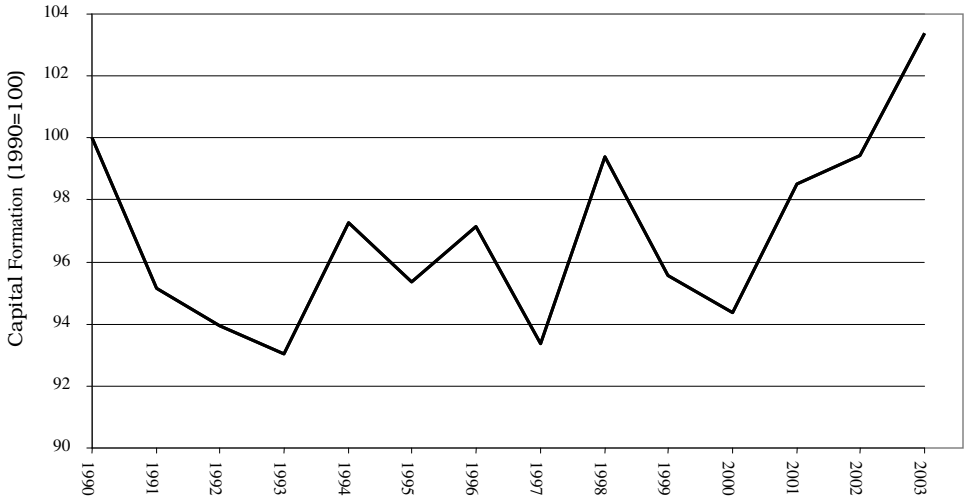


Fig. 12: Annual Mean Gross Capital Formation: Africa: 1990-2003

Through out the sample period except for the period 2001-2003, the highest annual mean capital formation was in the southern region. Mean annual gross capital formation for northern region was the second highest for all years except for the period 2001-2003 when it overtook the southern region. Annual mean capital formation for eastern, western and central regions fluctuated annually overtaking each other in different years (Fig.13).

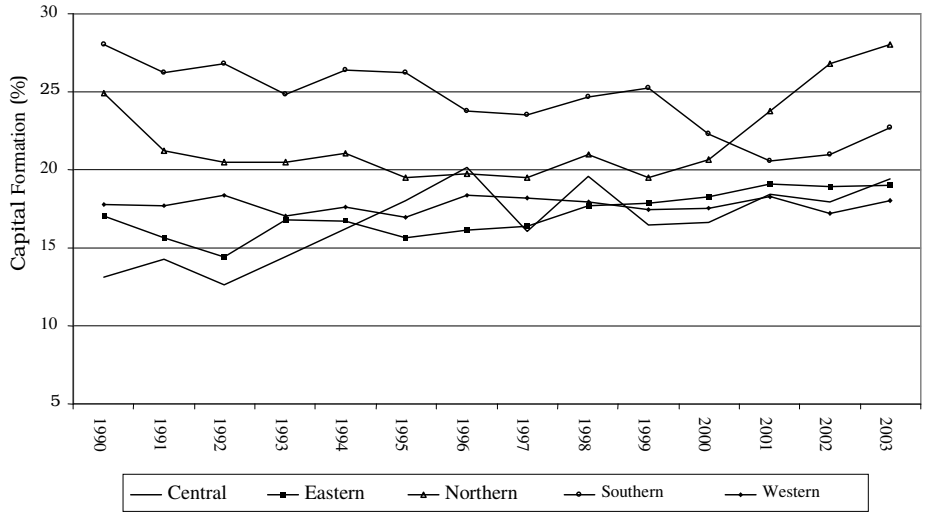


Fig. 13: Annual Mean Gross Capital Formation: African Regions, 1990-2003

All regions had periods when annual mean capital formation declined below the base period. The mean capital formation for the central region was above the base year for all years except for the period 1991-1992 and it increased every year except for 1991-1992 and 1996-1997 and 1998-1999. The annual mean capital formation for northern, eastern, western and southern regions were lower than the base year for all years except eastern region for 1998-2003, northern region for 2000-2003 and western for 2000-2001 (Fig 14).

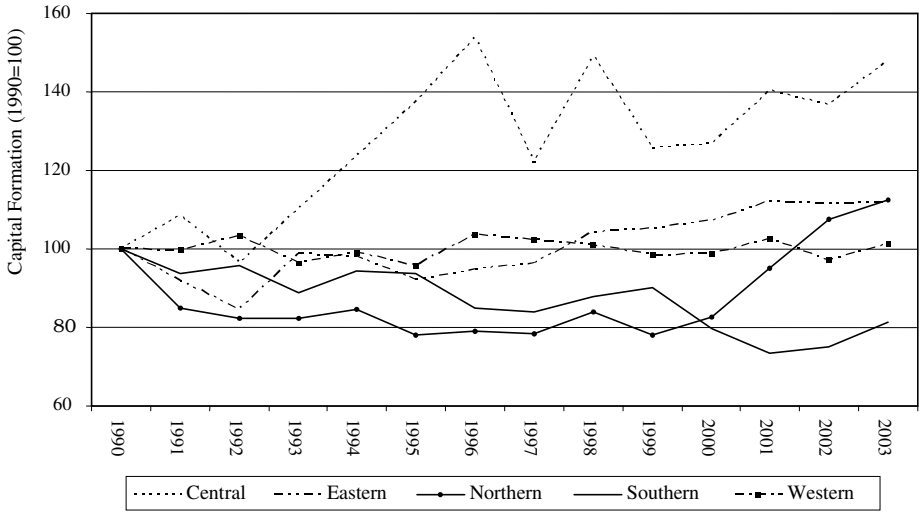


Fig. 14: Annual Mean Gross Capital Formation Index: African Regions, 1990-2003

Inflation Rate

The annual mean inflation rate fluctuated through out the sample period ranging from 19.8% in 1990 to 8.3% in 2003 and decreased for all the period except for 1990-1992, 1995-1996 and 1993-1994 when it increased six fold (Fig. 15, Table 3). The very high increase in 1994 is attributed to the high level for Democratic Republic of Congo (23773.13%) whose currency almost collapsed and was suffering from hyperinflation due to war. The general decrease after the mid 1990s is consistent with stringent conditions that were placed on African economies by IMF and World Bank in the wake of liberalization that required governments to limit inflationary policies like high public expenditure and subsidization of parastatals.

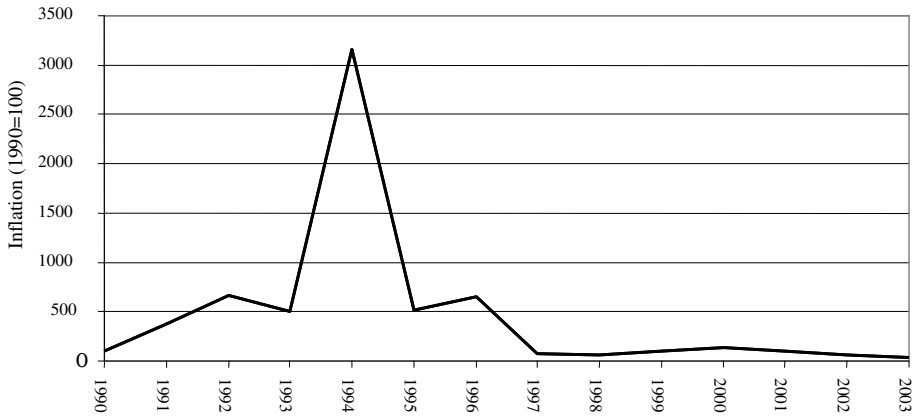


Fig. 15: Annual Mean Inflation Rate: Africa: 1990-2003

During the sample period, annual mean inflation rate was highest in the central region and lowest in the eastern region and in between were the southern, northern and western regions, in that order (Fig.16 and Fig.17).

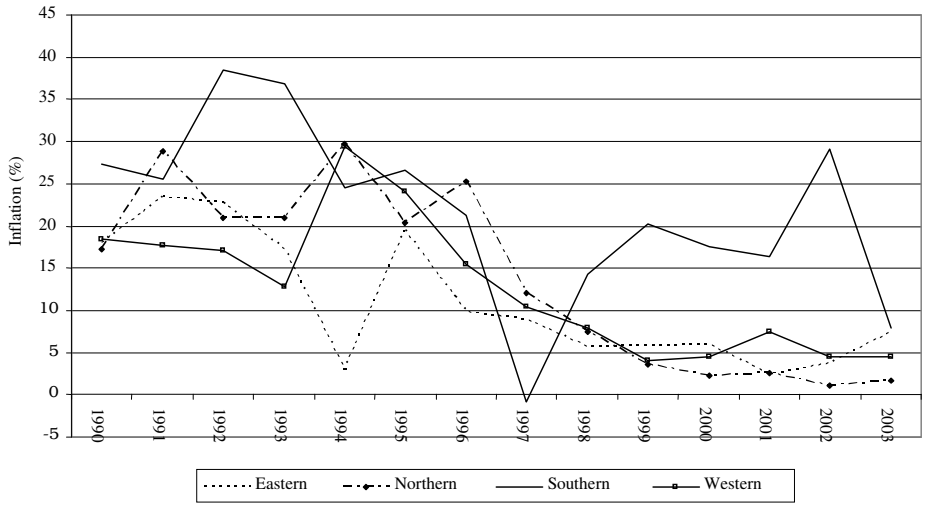


Fig. 16: Annual Mean Inflation Rate: Eastern, Northern, Southern and Western Regions, 1990-2003

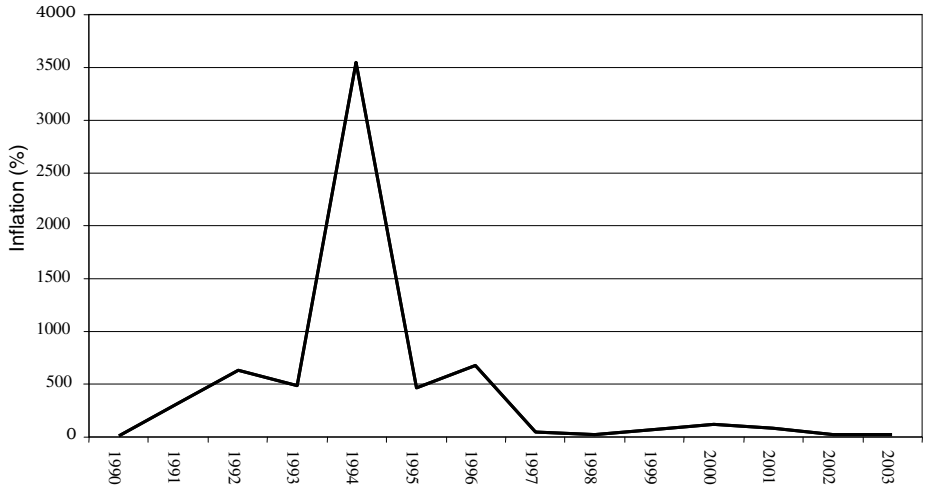


Fig. 17: Annual Mean Inflation Rate: Central Region, 1990-2003

All regions except the central region had some periods when the mean annual inflation rates declined below the base period. The annual mean inflation rate in the central region decreased for all years except for 1990-1992, 1995-1996 and 1993-1994 when it increased six fold (Fig.18 and Fig.19).

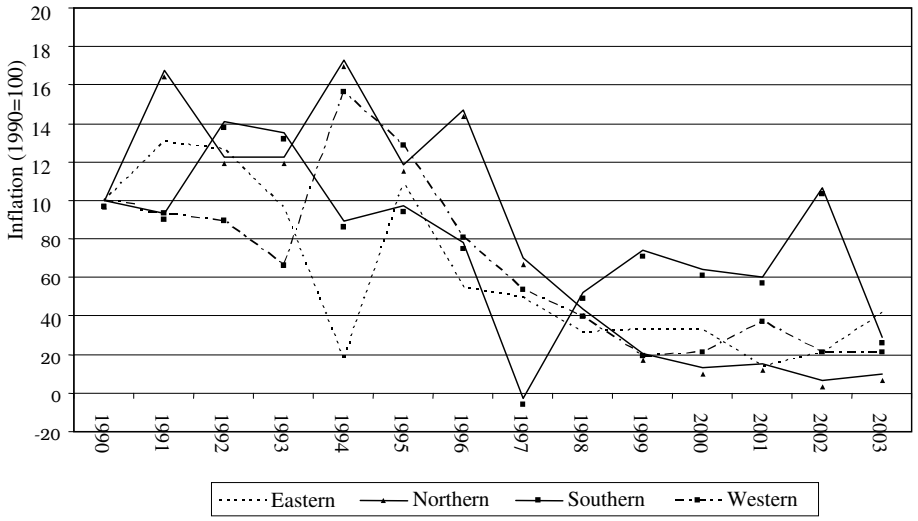


Fig. 18: Annual Mean Inflation Rate Index: Eastern, Northern, Southern and Western Regions, 1990-2003

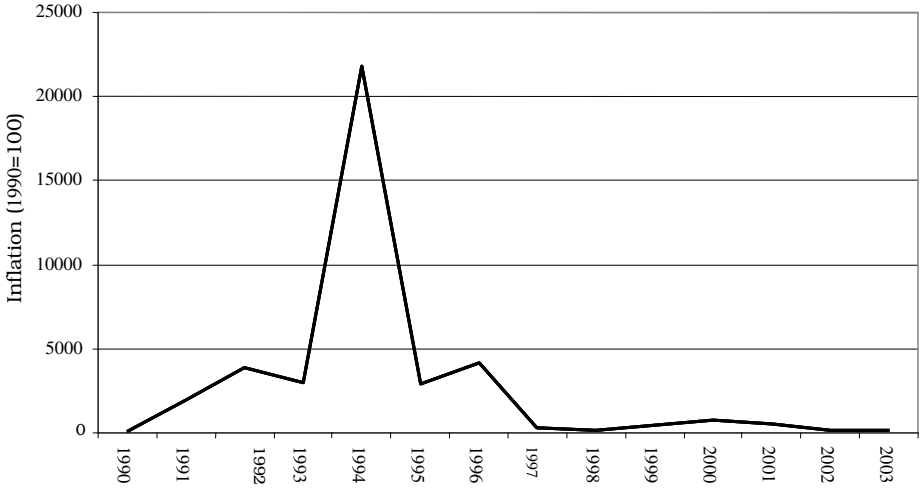


Fig. 19: Annual Mean Inflation Rate: Central Region, 1990-2003

Literacy Rate

The annual mean literacy rate during the sample period ranged from for 50.1% in 1990 to 64.2% in 2003 and increased through out the sample period reaching a peak in 2003 (Fig. 20, Table 3).

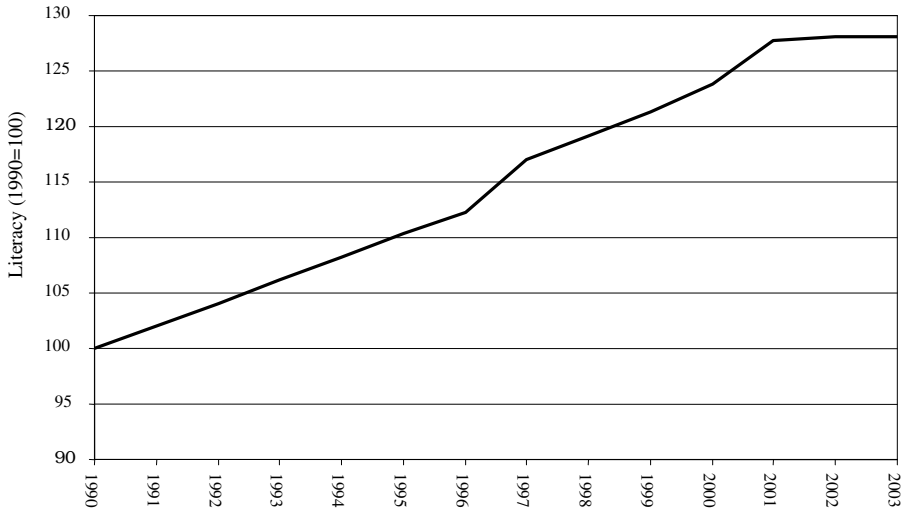


Fig. 20: Annual Mean Literacy Rate: Africa: 1990-2003

During the sample period, the lowest annual mean literacy rate was in the western region and the highest was in the southern region and in between were eastern, northern and central regions, in that order (Fig. 21).

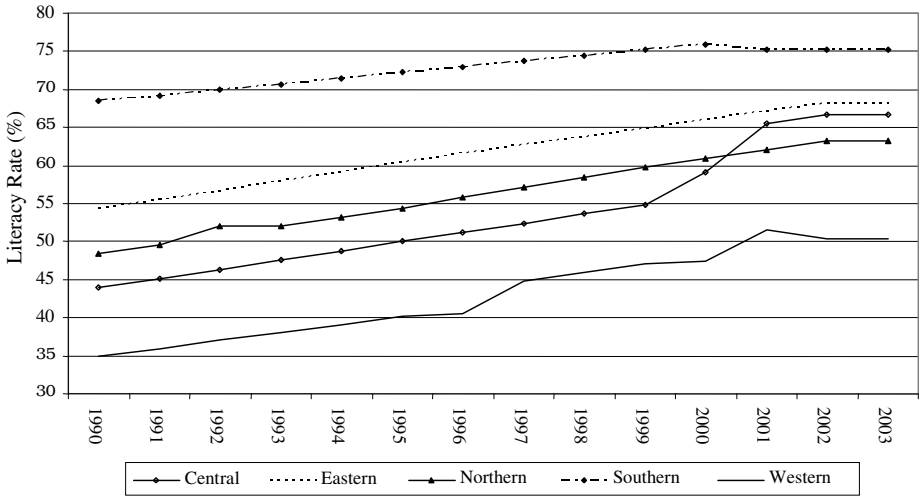


Fig. 21: Annual Mean Literacy Rate: African Regions, 1990-2003

The annual mean literacy rates for all regions were above the base period for all the years, increasing through out the sample period except for a decrease for western region in 2001-2002 (Fig.22).

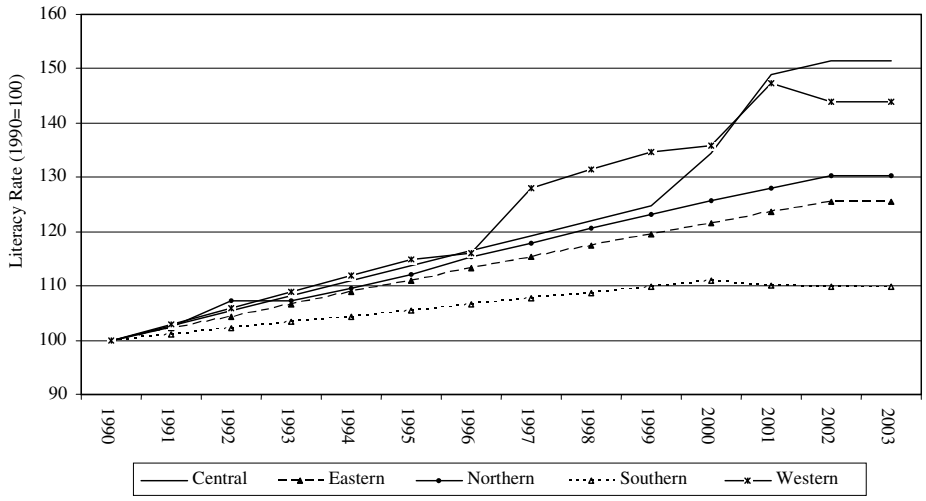


Fig. 22: Annual Mean Literacy Rate Index: African Regions, 1990-2003

Exchange Rate

The annual mean nominal exchange rate appreciated from 178.7 local currency units per dollar in 1990 to 1410.2 local currency units per dollar in 2003 and appreciated consistently through out the sample period (Fig. 23, Table 3). This positive trend is consistent with the appreciation of most of African currencies as the economies stabilized in the wake of the liberalization of their economies.

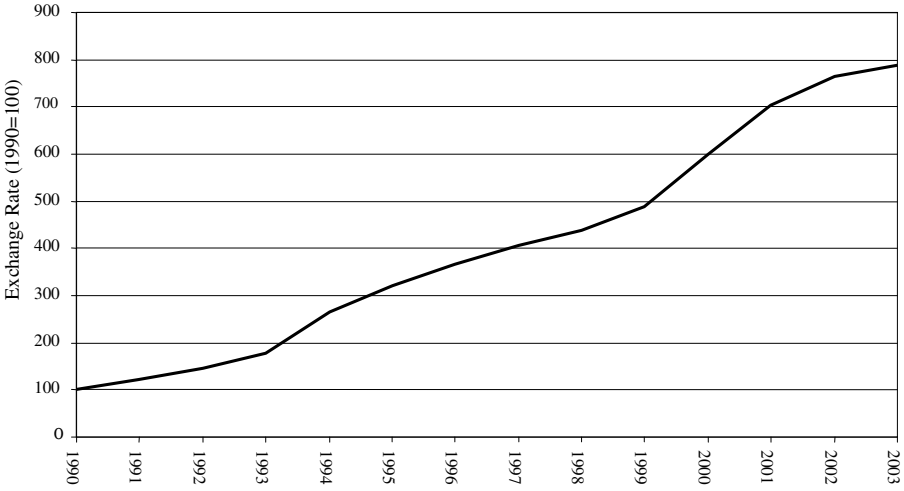


Fig. 23: Annual Mean Nominal Exchange Rate: Africa: 1990-2003

During the sample period, the lowest annual mean nominal exchange rate was in the northern region and the highest, for most of the years, was in the southern region, and in between were eastern, western and central regions, in that order (Fig. 24).

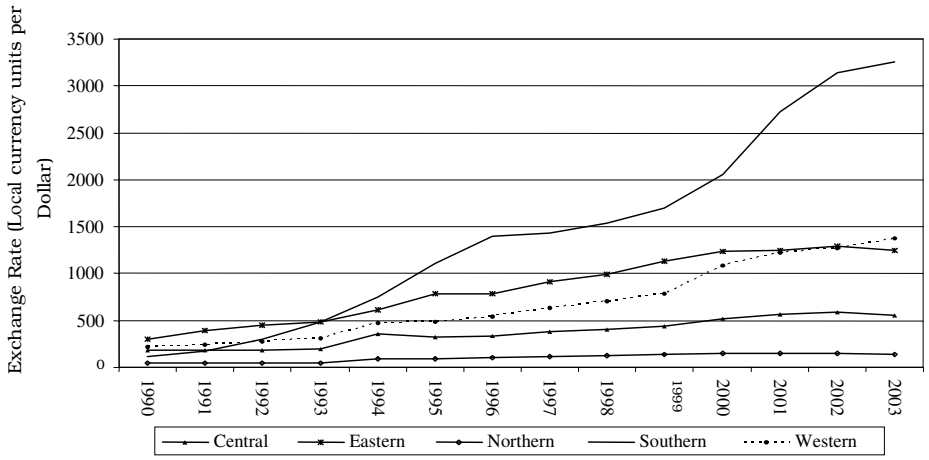


Fig. 24: Annual Mean Nominal Exchange Rate: African Regions, 1990-2003

The annual mean nominal exchange rates for all regions increased above the base period through out the sample period (Fig.25).

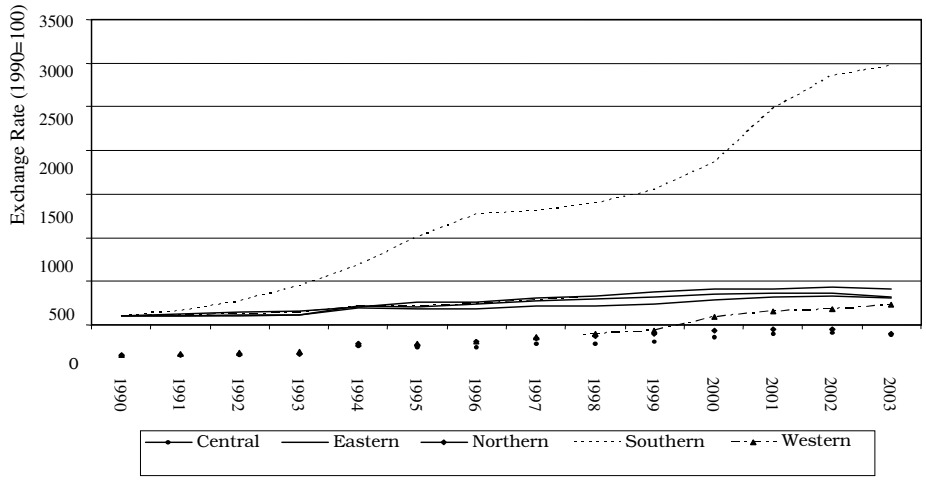


Fig. 25: Annual Mean Nominal Exchange Rate Index: African Regions, 1990-2003

Remoteness

Remoteness is the aggregate weighted distance of a host country from major foreign direct investment source countries. It was calculated by summing the products of the distances from the capital of each source country to the capital of the host country and the ratio of the GDP of the source country to the combined GDP of the major FDI source countries in the world.[2]

---

[2] $\text{Re}moteness_j = \sum_{i=1}^{I} \phi_i D_{ij}$

Where: $\phi_i = \frac{Y_i}{Y_w}$

Y_i = GDP for source country i Y_w = World GDP

D_{ij} = direct distance between source country i to host country j

The annual mean remoteness during the sample period increased from 1349.8 in 1990 to 1385.2 and increased consistently except between 1994-1998 and 2000-2003 (Fig. 26, Table 3).

Fig. 26: Annual Mean Remoteness: Africa: 1990-2003

During the sample period, the lowest annual mean remoteness was in the northern region and the highest was in the southern region, and in between were eastern, central and western regions, in that order (Fig. 27, Table 3). The low remoteness of the northern region may be attributed to its proximity to the western European countries which are major sources of foreign direct investment.

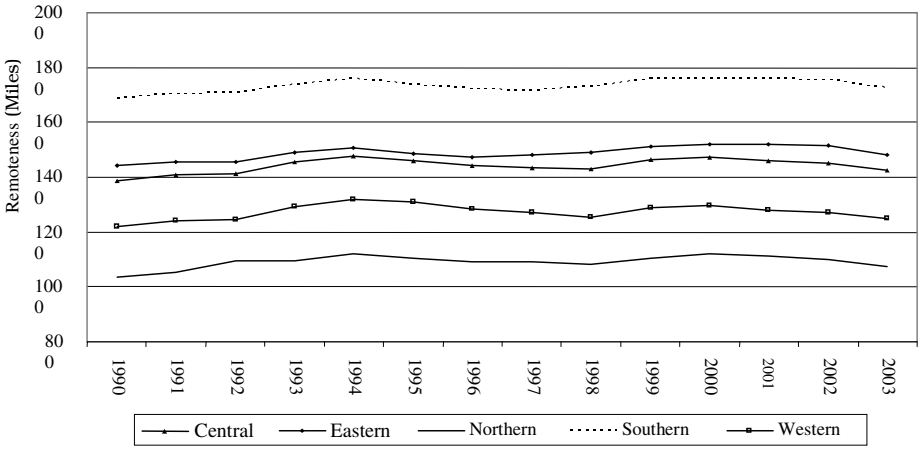


Fig. 27: Annual Mean Remoteness: African Regions, 1990-2003

The annual mean remoteness for all regions increased above the base period rising for all the years in the sample period except for the period 1994-1998 and 2000-2003 (Fig.28).

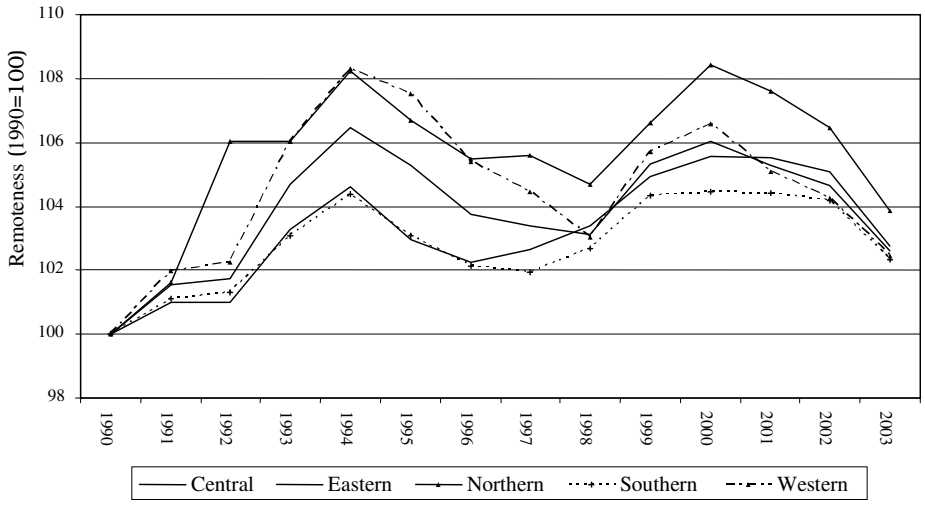


Fig. 28: Annual Mean Remoteness Index: African Regions, 1990-2003

Paved Roads

The annual mean percentage of paved roads during the sample period increased from 25.2% in 1990 to 34.7% in 2003 and grew consistently except for periods 1992-1994, 1995-1996 and 2000-2002 (Fig. 29, Table 3).

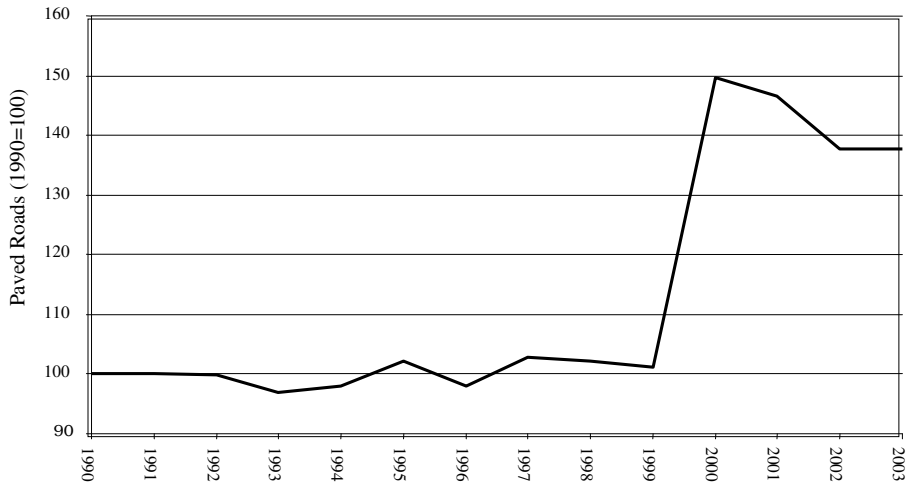


Fig. 29: Annual Mean Percentage Paved Roads: Africa: 1990-2003

During the sample period, the lowest annual mean percentage of paved roads for most of the years was in the central region and the highest was in the northern region, and in between were southern, western, and eastern regions in that order (Fig. 30).

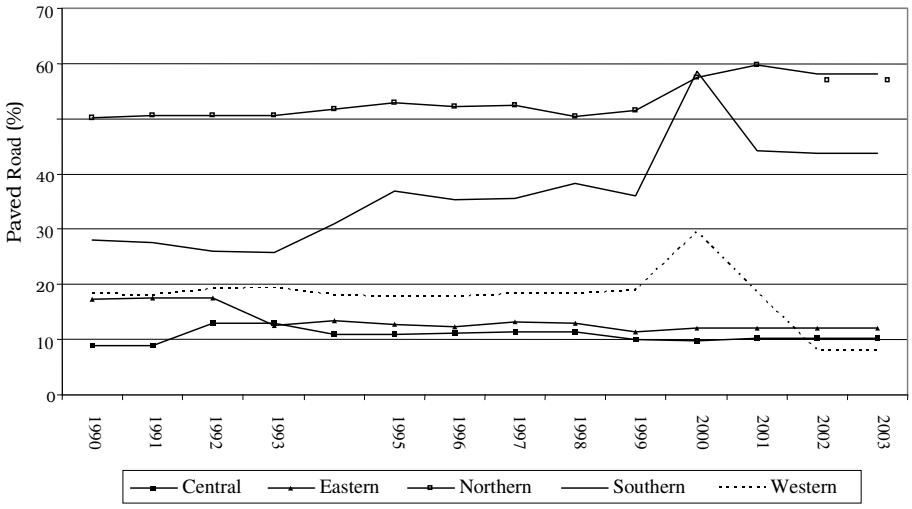


Fig. 30: Annual Mean Percentage Paved Roads: African Regions, 1990-2003

All regions except the southern and northern regions had periods when the annual mean percentage of paved roads declined below the base period: Eastern (1992-2003), Southern (1991-1993), western (1994-1998, 2002-2003) (Fig. 31).

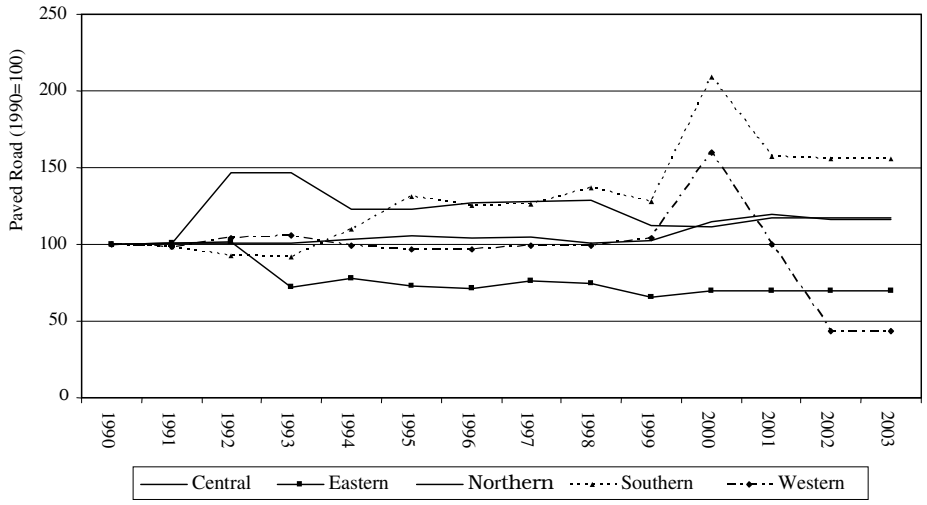


Fig. 31: Annual Mean Percentage Paved Roads Index: African Regions, 1990-2003

Openness

Openness is the trade index of a host country and is calculated as the ratio of exports + imports to GDP. The annual mean openness increased from 61.3% to 69.5% in 2003 and grew consistently except between 1990-1991, 1994-1997 and 2000-2001 (Fig. 32, Table 3). The general upward trend especially after the mid 1990s is consistent with the increase in trade that followed the liberalization of many African economies.

Fig. 32: Annual Mean Openness: Africa: 1990-2003

During most of the years, the lowest openness alternated between the northern and eastern region and the highest was in the southern region, and in between were central and western regions, in that order (Fig. 33).

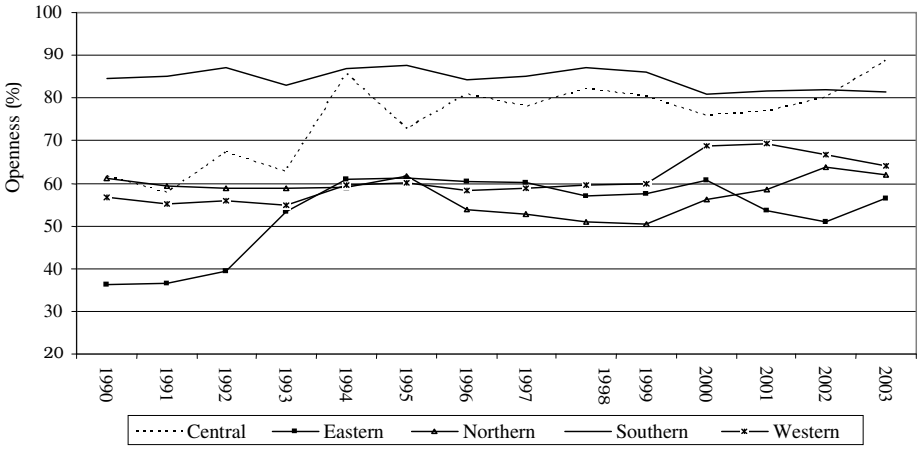


Fig. 33: Annual Mean Openness: African Regions, 1990-2003

Annual mean openness for all regions except northern and southern increased above the base period for all years. Annual mean openness for eastern region increased for all years except between 1997-1998 and 2000-2002 (Fig.34).

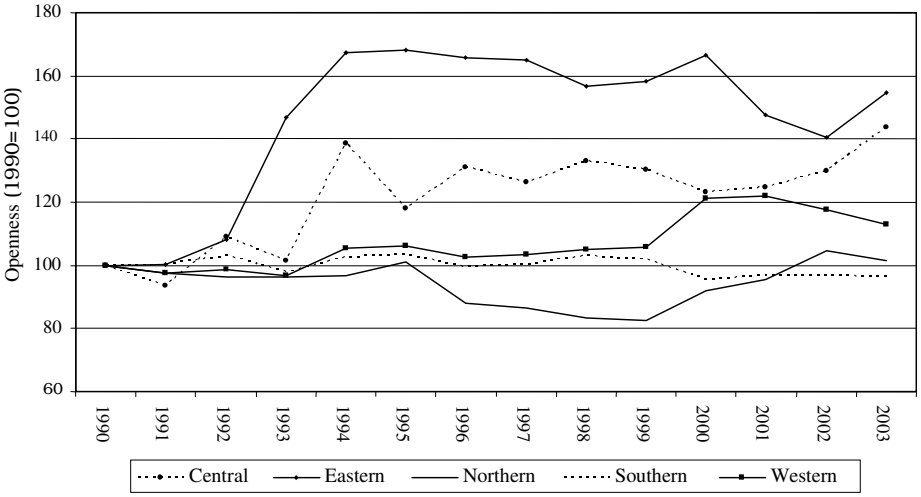


Fig. 34: Annual Mean Openness Index: African Regions, 1990-2003

Political stability Index

Political stability index is a measure of the civil and political rights in a host country. It is calculated as the average of the civil rights and political rights indices and is measured on the scale of 1 to 7, where an average of 1 represents the highest stability. The annual mean political stability index decreased from 5.2 in 1990 to 4.4 in 2003 and declined consistently except between1992-1993 and 1996-1997 (Fig. 35, Table 3).

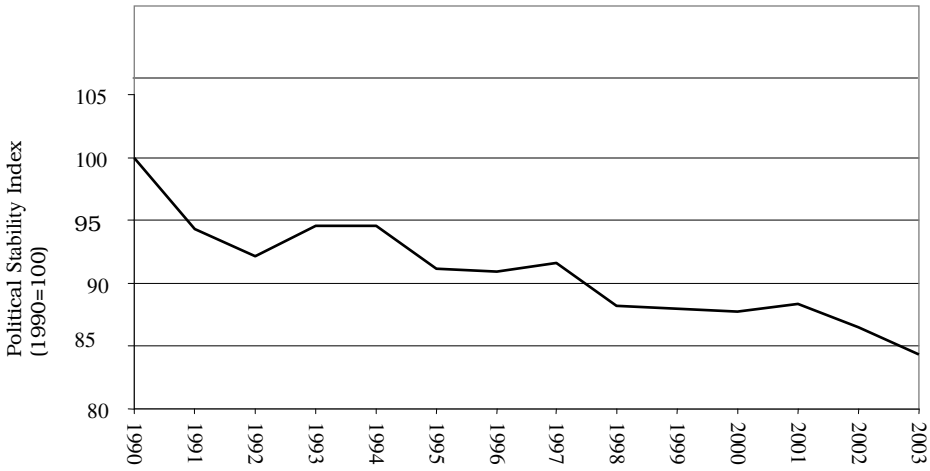


Fig. 35: Annual Mean Political Stability Index: Africa: 1990-2003

During the sample period, the lowest annual mean political stability index was in southern region and the highest, for most of the years was the northern region, and in between were central, eastern and western regions, in that order (Fig.36).

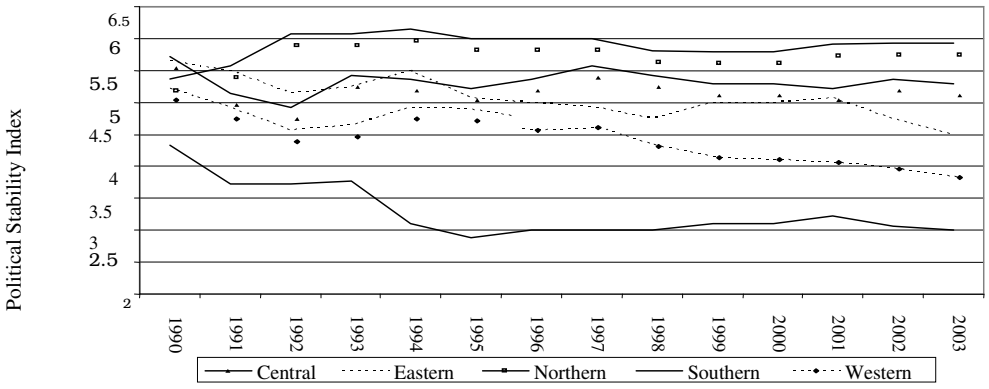


Fig. 36: Annual Mean Political Stability Index: African Regions, 1990-2003

The annual mean political stability index for all regions fell below the base period for all years except the northern region. The annual mean political stability index for the northern region was above the base period every year but remained almost constant through out the sample period (Fig.37).

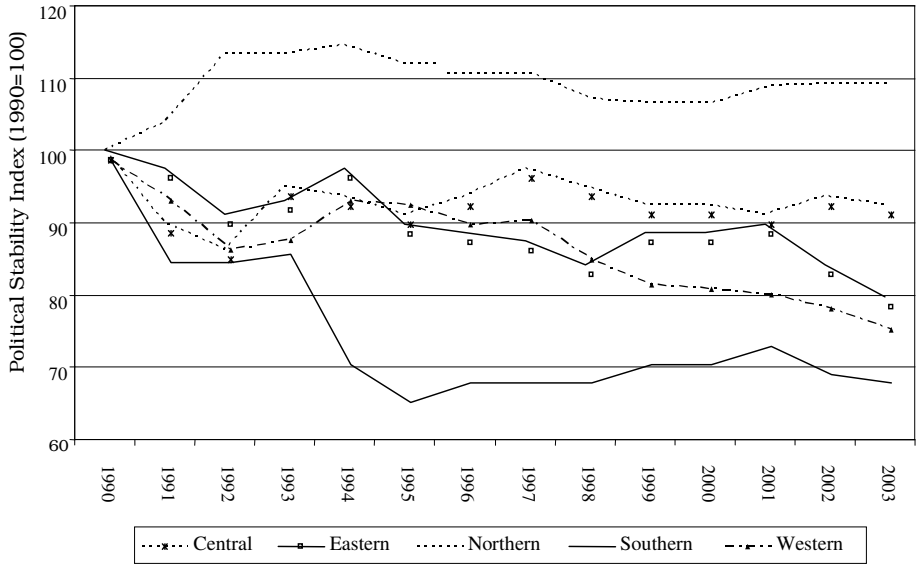


Fig. 37: Political Stability Index: African Regions, 1990-2003

The Econometric Model

The econometric model of foreign direct investment in Africa is specified as follows

.

$$(1) \quad FDI_{it,} = \alpha + \beta_1 GDP_{it} + \beta_2 REM_{it} + \beta_3 CFOM_{it} + B_4 ROAD_{it} + \beta_5 INFRAT_{it} + \beta_6 lnLIT_{it} + \beta_7 POLISTA_{it} + B_8 OPEN_{it} + \beta_9 EXR_{it} + \beta_{10} R_1 + \beta_{11} R_2 + \beta_{12} R_3 + \beta_{13} R_4 + \epsilon_{it}$$

where i denotes the country, FDI_{it} is the foreign direct investment, GDP_{it} is gross domestic product, $INFLAT_{it}$ is inflation rate, EXR_{it} is the exchange rate, LIT_{it} is the literacy rate, $CFOM_{it}$ is capital formation, $ROAD_{it}$ is percentage of paved roads, REM_{it} is a measure of remoteness, $OPEN_{it}$ is a measure of openness, and $POLISTA_{it}$ is an index of political stability and R_1 – R4 are regional dummies. The parameters to be estimated include the constant term, α, and $\beta_k (k = 1,2,\ldots, 13)$. The residual term is $\varepsilon_{it.}$

The specification of foreign direct investment (1) is based on conventional modeling of foreign direct investment in the foreign direct investment studies and expresses foreign direct investment (FDI_{it}) in terms of infrastructure ($CFOM_{it}$) and ($ROAD_{it}$), exchange rate (EXR_{it}), market size (GDP_{it}), macroeconomic conditions ($INFLAT_{it}$), labor market conditions (LIT_{it}), economic policy ($OPEN_{it}$), political stability (POL_{it}), and international economic relations (REM_{it}).

The estimated model will be used to test the hypotheses about individual relationships of the independent variables (*CFOM*, *ROAD, EXR*, *GDP*, *INFLAT*, *LIT*, *OPEN, POL,* and *REM)* and foreign direct investment in Africa. A brief description of the hypotheses is in the following section.

Gross Domestic Product (*GDP*)

Market seeking foreign direct investment is sustainable in a country with a large market (physical size, purchasing power, income) due to economies of scale (Chen, 1997; Aggarwal, 2005). In this study host country market size is measured by gross domestic product with the postulation that market size has a positive effect on foreign direct investment (2). Specifically:

(2) Ho: $\beta_1 = 0$; H_A: $\beta_1 > 0$;

where β_1 is the estimated coefficient of ***GDP*** (gross domestic product) in the foreign direct investment model (1).

Remoteness (*REM)*

Remoteness is a composite measure of spatial economic configuration[3] between two countries and captures the importance of transportation and information costs on foreign direct investments (Merlevede and Schoors, 2004). Foreign direct investment is less likely to occur when the returns to investments are more than offset by transportation and transactional costs arising out of distance and location factors in the host country (Deardorff ,1995; Lall, et. al,

[3] Volume, composition and value of transactions between two countries as well as location effects

2003). These suggest a negative relationship between remoteness and foreign direct investment to be tested with following hypothesis (3).

(3) Ho: $\beta_2 = 0$; H_A: $\beta_2 < 0$;

where β_2 is the estimated coefficient of ***REM*** (remoteness) in the foreign direct investment model (1).

Capital Formation (*CFOM)*

In this study, capital formation is used as a proxy for infrastructure[4] which facilitates business operations and reduces transactions and operations costs thus increasing returns to investments. Foreign direct investment is more likely to be attracted to a country with a higher than a country with a lower rate of capital formation. The hypothesis for the effect of capital formation on foreign direct investment is formulated as follows (4).

(4) Ho: $\beta_3 = 0$; H_A: $\beta_3 > 0$;

where β_3 is the estimated coefficient of *CFOM* (capital formation) in the foreign direct investment model (1).

Paved roads (*ROAD)*

The quality and size of national road network have important implications for business operations costs. A host country with an expansive network of paved roads is likely to attract foreign direct investments since the transportation costs as well as cost of maintaining transportation machinery and

[4] Investments in transportation, utilities, communications and physical facilities

equipments are likely to be lower and returns to investments higher than a country with a more limited network of paved roads. The hypothesis for the effect of quality of road transportation on foreign direct investment is formulated as follows (5):

(5) Ho: $\beta_4 = 0$; H_A: $\beta_4 > 0$;

where β_4 is the estimated coefficient of ***ROAD*** (percentage paved roads) in the foreign direct investment model (1).

Inflation Rate (*INFRAT*)

In this study inflation rate is used as a proxy for macroeconomic environment which has potentially adverse effects on returns to investment through high transactions costs as well as risk and uncertainty. Foreign direct investment is more likely to be attracted to a country with a lower than a country with a higher inflation rate. The hypothesis for the effect of inflation on foreign direct investment is formulated as follows (6).

(6) Ho: $\beta_5 = 0$; H_A: $\beta_5 < 0$;

where β_5 is the estimated coefficient of ***INFRAT*** (inflation rate) in the foreign direct investment model (1).

Literacy Rate (*LIT*)

Resource seeking foreign direct investment is predicated upon availability of low cost resources and inputs in the host country. Labor is an important element of production costs and the higher the labor productivity the higher the returns to investments. This study uses literacy rate as a proxy for the quality of labor

and tests the following hypothesis (7) about the relationship between literacy rate and foreign direct investments.

(7) Ho: $\beta_6 = 0$; H_A: $\beta_6 > 0$;

where β_6 is the estimated coefficient of ***LIT*** (literacy rate) in the foreign direct investment model (1).

Political Stability (*POLISTA)*

Political stability of a host country provides an enabling business and investment environment leading to competitive returns to investments. In this study the hypothesis is that political stability is positively related to foreign direct investment and is tested with the following formulation (8):

(8) Ho: $\beta_7 = 0$; H_A: $\beta_7 > 0$;

where β_7 is the estimated coefficient of ***POLISTA,*** a measure of political stability in the foreign direct investment model (1).

Economic Liberalization (*OPEN)*

Many African countries adopted the structural adjustment program of the IMF in the early eighties that transformed the economies from centrally planned to market based economic activities. This involved lifting restrictions on trade and investments, bureaucratic reforms as well as monetary and fiscal liberalization. The hypothesis about the effect of economic liberalization is formulated as follows (9):

(9) Ho: $\beta_8 = 0$; H_A: $\beta_8 > 0$;

where β_8 is the estimated coefficient of ***OPEN,*** a measure of economic liberalization in the foreign direct investment model (1).

Exchange Rate (*EXR*).

The stability and magnitude as well as frequency of changes in the exchange rate have important implications for investment, production and trade decisions. The magnitude of exchange rate impacts the cost of investment and profits that a multinational firm can repatriate. A real deprecation of a country's foreign exchange leads to more foreign direct investment as foreign firms try to take advantage of relatively cheaper domestic inputs. On the other hand unanticipated currency appreciation or depreciation increases business risks and uncertainty of returns with potentially adverse effects on investments decisions. The hypothesis about the relationship between exchange rate and foreign direct investment is (10):

(10) Ho: $\beta_9 = 0$; H_A: $\beta_9 \neq 0$;

where β_9 is the estimated coefficient of ***EXR,*** (exchange rate) in the foreign direct investment model (1).

Regional dummy Variables (R_i)

Firms tend to be attracted to regions where other firms already exist due to agglomeration economies arising from positive externalities, like availability of skilled labor force and specialized inputs, knowledge spillover and presence of users and suppliers of intermediate inputs (Campos and Kinoshita, 2003; Agiomirgianakis, et.al, 2006).

The hypotheses about regional differences are formulated as follows;

(11) Ho: $\beta_k = 0$; H_A: $\beta_k \neq 0$; (k=10, 11, 12, 13);

where (β_{10} β_{11} β_{12} β_{13}) are the regional coefficients for Central, Eastern, Western, Northern regions, respectively while the southern region is the base region.

The Empirical Model

The foreign direct investment model (1) is re-specified as a panel data model to be estimated using annual data from 1990 through 2003 for 45 African countries as follows.

$$(12) \quad lnFDI_{it} = \lambda + \alpha_i + \beta_1 lnGDP_{it} + \beta_2 lnREM_{it} + \beta_3 lnCFOM_{it} + \beta_4 lnROAD_{it} + \beta_5 lnINFRAT_{it} + \beta_6 lnLIT_{it} + \beta_7 lnPOLISTA_{it} + \beta_8 lnOPEN_{it} + \beta_9 lnEXR_{it} + \beta_{10} R_1 + \beta_{11} R_2 + \beta_{12} R_3 + \beta_{13} R_4 + \epsilon it$$

where λ is the common intercept mean for all countries, α_i is the country-specific effects[5], i denotes country, t denotes year, and variables are: foreign direct investment (FDI_{it}), gross domestic product (GDP_{it}), inflation rate ($INFLAT_{it}$), exchange rate (EXR_{it}), literacy rate (LIT_{it}), capital formation ($CFOM_{it}$), percentage of paved roads ($ROAD_{i,t}$), a measure of remoteness ($REM_{i,t}$), a measure of openness ($OPEN_{it}$), an index of political stability

[5] Only the mean country intercept term is reported in the results because $\sum_{i=1}^{N} a_i = 0$.

(POLISTA$_{it}$); and R_1 , R_2 , R_3 and R_4 are the regional dummy variables. All variables are in log form except the regional dummies. The variables were logged because conventionally foreign direct investment, being a flow variable, it is modeled by gravity model which is usually specified as a double log model. The parameters to be estimated are α_i, β_1, $\beta_{2,.....,}\beta_{13,}$ and ε_{it} is the residual term.

The model (12) was estimated as fixed effect panel data model[6] following the Breusch-Pagan and Hausman specification tests[7], and since diagnostic tests[8] indicated the presence of heteroscedasticity as well as endogeneity between FDI and GDP, we applied the Feasible Generalized Least Squares estimation technique with lagged value of GDP, respectively.

In order to investigate the possible impact of host country population on the market size, model (12) was re-estimated by including population of host country as one of the independent variables. Including population allowed us to test for the sensitivity of the model to another variable that affects marketing seeking foreign direct investment apart from GDP percapita.

[6] Random effects model results were presented in the Appendix for comparison purposes.
[7] See Appendix I for details of the tests
[8] See Appendix II for details of the tests

CHAPTER FOUR
EMPIRICAL RESULTS, ANALYSIS AND POLICY IMPLICATIONS

Results of the Feasible Generalized Least Squares estimates of foreign direct investments in Africa without the population variable are presented in Table 4 and show that the estimated coefficients for Gross Domestic Product, Inflation Rate, Literacy Rate, Exchange Rate, and Remoteness were statistically significant. As for the regional dummies, the estimated coefficients of the central and western regional dummies were statistically significant[9].

[9] Random effects model results (Appendix III and IV) are almost similar to those of FGLS because FGLS removes the country effects from the model and also corrects for heteroscedasticity.

Table 4: Feasible Generalized Least Squares Estimates of Foreign Direct Investments in Africa without population.

Variable definition	Variable	Estimated Coefficients	Z- value	P- value
Gross Domestic Product	LAGDP	0.522*** (0.145)	3.600	0.000
Capital Formation	LCFOM	-0.141 (0.237)	-0.600	0.551
Inflation Rate	LINFLAT	-0.176*** (0.066)	-2.650	0.008
Literacy Rate	LLIT	0.952*** (0.295)	3.230	0.001
Exchange Rate	LEXR	0.298*** (0.040)	7.380	0.000
Remoteness	LREM	-3.565*** (1.013)	-3.520	0.000
Paved Roads	LROAD	-0.093 (0.123)	-0.750	0.452
Openness	LOPEN	0.061 (0.311)	0.200	0.844
Political Stability	LPOLISTA	-0.242 (0.300)	-0.810	0.419
Central Region	R1	-1.503*** (0.495)	-3.040	0.002
Eastern Region	R2	-0.260 (0.391)	-0.660	0.507
Western Region	R3	-1.975*** (0.308)	-6.420	0.000
Northern Region	R4	0.500 (0.482)	1.040	0.300
Constant	CONS	23.355*** (7.517)	3.110	0.002
Number Of Observations	197			
Wald Chi-Square	563.06			
Probability	0.000			

*** Significant at 1% Standard errors in parenthesis

The estimated coefficients of gross domestic product, exchange rate, remoteness, literacy rate and inflation rate were all statistically significant at 1%.

Hypothesis tests of significance led to the rejection of hypotheses about the estimated coefficient (Table 4) of the following, at 1% level of significance.

a. Gross domestic product (H_o: $\beta_1 = 0$; H_A: $\beta_1 > 0$);

b. Remoteness (H_o: $\beta_2 = 0$; H_A: $\beta_2 < 0$);

c. Inflation rate (H_o: $\beta_5 = 0$; H_A: $\beta_5 < 0$);

d. Literacy rate (H_o: $\beta_6 = 0$; H_A: $\beta_6 > 0$);

e. Exchange rate (H_o: $\beta_9 = 0$; H_A: $\beta_9 \neq 0$).

f. Central region (H_o: $\beta_{10} = 0$; H_A: $\beta_{10} \neq 0$);

g. Western region (H_o: $\beta_{13} = 0$; H_A: $\beta_{13} \neq 0$

However, the null hypotheses about the following were not rejected.

a. Capital formation (H_o: $\beta_3 = 0$; H_A: $\beta_3 > 0$)

b. Paved roads (H_o: $\beta_4 = 0$; H_A: $\beta_4 > 0$);

c. Political stability (H_o: $\beta_7 = 0$; H_A: $\beta_7 > 0$);

d. Economic liberalization (H_o: $\beta_8 = 0$; H_A: $\beta_8 > 0$);

e. Eastern region (H_o: $\beta_{11} = 0$; H_A: $\beta_{11} \neq 0$);

f. Northern region (H_o: $\beta_{12} = 0$; H_A: $\beta_{12} \neq 0$).

The estimated coefficients of gross domestic product and literacy rate are positive as expected, and using a 95% confidence interval, the computed elasticities between 0.237 and 0.805 (gross domestic product) and between 0.375 and 1.529 (literacy rate). Therefore a 1% increase in literacy rate leads to an increase in foreign direct investment

to Africa of between 0.37% and 1.53%. And a 1% increase in GDP leads to an increase in foreign direct investment to Africa of between 0.24% and 0.80%.

The positive sign on the estimated coefficient of gross domestic product is consistent with market seeking hypothesis of foreign direct investment and supports empirical evidence from previous studies of foreign direct investment in Central and Eastern European Countries, the Baltics and Commonwealth of Independent States (Campos and Kinoshita, 2003; Resmini, 2000); Kenya, Uganda and Tanzania (Todd, *et al.*, 2004); Organization of Economic Cooperation and Development Countries (Agiomirgianakis, *et al.,* 2006); developed countries (Amaya and Rowland, 2000); developing countries (Chen, 1997; Nonnemberg and Mendonca, 2004; Akinkugbe, 2003; Amaya and Rowland, 2000) as well as Caribbean and Latin American countries (Lall, *et al.*, 2003). Similarly, the positive sign on the estimated coefficient of literacy rate is tenable on the basis of resource-seeking and the factor proportions hypotheses of foreign direct investment. Furthermore, it corroborates results of previous foreign direct investment studies in Morocco Bouoiyour, 2003); Central and Eastern European Countries, the Baltics and Commonwealth of Independent States (Campos and Kinoshita, 2003); Asia and Latin America (Chantasasawat, *et al.*, 2005); the Caribbean (Lall, *et al.*, 2003); Kenya Uganda and Tanzania (Todd, *et al.*, 2004); developed countries (Addison and Heshmati, 2003); developing countries (Addison and Heshmati, 2003); China (Fung, *et al.*, 2002) and Sub-Saharan countries (Cleeve, 2004).

The estimated coefficients of inflation rate and remoteness are negative as expected, and the computed elasticities are between -0.303 and -0.045 (inflation rate) and between -5.549 and -1.580 (remoteness). Therefore, a 1% increase in inflation rate leads to a

decrease in foreign direct investment to Africa of between 0.04% and 0.30%. And a 1% increase in remoteness leads to a decrease in foreign direct investment to Africa of between 1.58% and 5.54%.

The negative sign on estimated coefficient of inflation rate is consistent with the portfolio diversification theory of foreign direct investment which states that a firm may reduce risk by undertaking projects in more than one country since the returns on activities in different countries are likely to be less than perfectly correlated. Furthermore, it corroborates results of previous foreign direct investment studies in developing countries (Root and Ahmed, 1979; Nonnemberg and Mendonca, 2004; Busse and Hesefer, 2006) and Sub-Saharan African countries (Aseidu, 2003).

Similarly, the negative sign on the estimated coefficient of remoteness is tenable on the basis of the gravity theory of foreign direct investment which states that the level of foreign direct investment flow between two countries varies directly with market size of the two areas and inversely with the distance between them (Chunlai, 1997).

Furthermore, it corroborates results of previous foreign direct investment studies in Eastern and Central Europe (Merlevede and Schoors, 2004); the Caribbean and Latin America (Lall *et al.*, 2003) and developing countries (Chen, 1997).

The estimated coefficient of exchange rate is positive and the computed elasticity is between 0.218 and 0.376. Therefore a 1% increase in exchange rate leads to an increase in foreign direct investment to Africa of between 0.22% and 0.38%. However, there was no *a priori* expectation on the sign of coefficient of exchange rate.

The positive sign on the estimated coefficient of exchange rate is consistent with the currency differential theory of foreign direct investment which states that international

direct investment flows tend to move out of countries with relatively stronger currencies to those with weaker currencies. Furthermore, it corroborates results of a previous study in Australia (Isabel, 2005). However, it is contrary to portfolio diversification theory of foreign direct investment as well as results of previous foreign direct investment studies in the United States and Sub-Saharan Africa (Froot and Stein, 1991 and Cleeve, 2004).

Finally the estimated coefficients of central and western regional dummies are negative and the computed elasticities are between -2.473 and -0.533 (central region) and between -2.577 and -1.371 (western region). On average, foreign direct investment was between 0.53% and 2.47% less for a country in the central region and between 1.37% and 2.58% less for a country in the western region than for a comparable country in the southern region. However, there were no *a priori* expectations on the signs of coefficients of the regional dummies.

Table 5: Feasible Generalized Least Squares Estimates of Foreign Direct Investments in Africa with Population.

Variable definition	Variable	Estimated Coefficients	Z- value	P- value
Gross Domestic Product	LAGDP	0.711*** (0.143)	4.970	0.000
Capital Formation	LCFOM	0.188 (0.216)	0.870	0.386
Inflation Rate	LINFLAT	-0.203*** (0.062)	-3.300	0.001
Literacy Rate	LLIT	0.747*** (0.261)	2.870	0.004
Exchange Rate	LEXR	0.178*** (0.037)	4.790	0.000
Remoteness	LREM	-1.541 (0.962)	-1.600	0.109
Paved Roads	LROAD	-0.264** (0.118)	-2.240	0.025
Openness	LOPEN	1.129*** (0.272)	4.150	0.000
Political Stability	LPOLISTA	-0.219 (0.269)	-0.810	0.416
Population	LPOP	1.029*** (0.094)	10.900	0.000
Central Region	R1	-0.920** (0.410)	-2.240	0.025
Eastern Region	R2	-0.980*** (0.375)	-2.610	0.009
Western Region	R3	-0.859*** (0.304)	-2.830	0.005
Northern Region	R4	0.115 (0.434)	0.260	0.792
Constant	CONS	-12.753 (7.791)	-1.640	0.102
Number Of Observations	197			
Wald Chi-Square	694.6			
Probability	0.000			

*** Significant at 1% ** Significant at 5% Standard errors in parenthesis

Inclusion of population in the model does not affect the sign and significance of most of the coefficients except for paved roads, openness and eastern region which now become significant and the population variable is also significant. The estimated coefficient of paved roads is unexpectedly negative, and the computed elasticity is between -0.494 and 0.033. Since Zero is in the interval, we cannot be confident that paved roads have a significant relationship with foreign direct investment in Africa.

The estimated coefficient of openness is positive as expected, and the computed elasticity is between 0.595 and 1.661. Therefore a 1% increase in openness leads to an increase in foreign direct investment to Africa of between 0.60% and 1.66%. This is consistent with the vertical or export-oriented foreign direct investment and supports empirical evidence from previous studies of foreign direct investment in Sub-Saharan Africa (Aseidu, 2002), developing countries (Busse and Hefeker, 2006) and Latin America, East and Southeast Asia and China (Chantasasawat, et. al, 2005).

The estimated coefficient of population is positive as expected, and the computed elasticity is between 0.844 and 1.213. Therefore a 1% increase in openness leads to an increase in foreign direct investment to Africa of between 0.84% and 1.21%. This is consistent with market seeking hypothesis of foreign direct investment.

Finally the estimated coefficient of the eastern regional dummy is negative and the computed elasticity is between -1.715 and -0.243. Therefore on average, foreign direct investment was between 0.24% and 1.72% less for a country in the eastern region than for a comparable country in the southern region.

Discussion, conclusions and policy implications

The results predict the individual relationships between gross domestic product, remoteness, inflation rate, literacy rate and exchange rate and foreign direct investments in Africa. Specifically, gross domestic product has a positive relationship with foreign direct investment in Africa.

Gross domestic product incorporates several dimensions of the economy but the estimated relationship in the foreign direct investment model suggests the importance of a growing domestic market, increasing and more efficient utilization of natural resources, improving public policy and administration as well as a more enabling business environment. Policies to promote sustainable economic growth and development can create domestic capacity to maximize benefits from foreign direct investments which in turn will strengthen the domestic economy through greater competitiveness, expanded domestic and export markets and optimal financial resource allocation.

Literacy rate is expected to have a positive relationship with foreign direct investment in Africa. Literacy rate is an indicator of education and skill levels of the labor force. An educated and skilled labor force is productive and leads to higher profitability and returns to investment which attracts foreign direct investment. Therefore, policies to increase access to formal education and strengthen vocational education can widen the human resource base and increase labor productivity to the benefit of domestic economic activities including foreign direct investments.

High inflation rate signifies increase in risk and uncertainty and has a deleterious impact on foreign direct investment because it reduces the expectations of returns on investments. Consequently, “if foreign investors are risk averse (or even risk neutral),

they will demand a high price to cover their exposure of that risk because they do not want to risk their expected profits from investment", which leads to reduction in foreign direct investment (Tahir and Larimo, 2002). Policies that control inflation rate can therefore reduce the risk and uncertainty to investment which will improve the business environment and attract foreign direct investment.

Location[10] has a negative relationship with investment location decisions through the impact on transaction costs. Long distances and high socio-cultural differences between the source and destination of foreign direct investment increase transaction costs in terms of information gathering and familiarity with local market conditions which reduces foreign direct investment. Policy actions to counteract the negative effect of location should be directed at publicity programs and international relations to increase awareness of investment opportunities in Africa. At the same time, public programs and incentives to enhance the investment climate have potential for mitigating the negative effects of location.

Depreciation of the domestic currency makes exports and domestic inputs cheaper and improves the competitiveness of the domestic economy resulting in increased foreign direct investment. However, unexpected movements in exchange rate may affect the expected rates of return to investment which impacts foreign direct investment and has important monetary and fiscal policy implications. Therefore, interventions in the foreign exchange market should be aimed at moderating the short-term movements in local currencies in order to reduce investment risks while ensuring a competitive exchange rate.

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[10] Geographical, cultural, historical and sociological

Openness has a positive relationship with foreign direct investment through reduction of trade barriers and transaction costs. This has a consequence of attracting export-oriented or vertical foreign direct investment to Africa. Therefore increased liberalization of African economies by lifting restrictions on trade and investments, bureaucratic reforms as well as monetary and fiscal liberalization has potential for increasing foreign direct investment to Africa.

On average countries in the southern region receive more foreign direct investment, than those in the central, western and eastern regions. This is consistent with the reports that foreign direct investment through out the 1990s and 2000s was higher in the southern and northern regions than in other regions (UNCTAD, 1998, 2004, 2005; Bank of Uganda, 2004).

Limitations of the study

As has been noted by United Nations Conference on Trade (UNCTAD, 2005), incomplete or lack of data is a big problem on studies on foreign direct investment especially for Africa. This did not spare this study either and this was a major consideration for the scope of this study. Data chosen for this study were from World Bank's World Development Indicators, Freedom House, Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), French Institute for Research on the International Economy.

APPENDICES

Appendix A

Panel data models and specification tests

Panel data is a combination of time series -regular temporal observations on the unit of analysis and a cross-section -observation on a unit of analysis at single time points (Bende-Nabende, 2002). Panel data analysis is important because, (1) it helps boost sample size which makes the results more reliable. It increases the number of data points, degrees of freedom and reduces multicollinearity of explanatory variables, (2) it helps to limit the effects of omission variable bias and estimates are unbiased even when there are some missing data for some time periods, (3) it allows for formulation of more complex hypotheses than would otherwise be in case of only time series or cross-sectional analysis (Hsiao, 2006). Panel data, however, may result in heterogeneity bias and selection bias if a wrong panel model is estimated. Heterogeneity bias arises when the panel data model used is inconsistent with the data generation process, like modeling heterogeneous cross-sectional units with a single intercept. Selection bias on the other hand is a result of a non-random selection of cross-sectional units that makes the sample non representative (Hsiao, 2006).

Equation (11), the general panel data model, can either be estimated as a fixed effect model, random effect model or pooled regression model.

The pooled-regression model is appropriate when there is neither significant country nor significant temporal effects such that the parameter vector is the same for all t, in which case all the data are pooled and estimated by OLS using data for all available years. The pooled regression model takes the form;

(13) $\ln FDI_{it} = \alpha + \beta' X_{it} + \varepsilon_{it}$ t = 1,……, T.

Where $X_i' = (x_{it}....)$ is the l × k row vector of logged independent variables.

The fixed effects panel model captures all temporally constant country-level effects. It's a linear regression model in which the intercept terms vary over individual countries and it takes the form;

(14) $$\ln FDI_{it} = \dot{\alpha}_i + \beta' X_{it} + \varepsilon_{it} \qquad \begin{matrix} i = 1,...,N, \\ t = 1,...,T, \end{matrix}$$

Where $\dot{\alpha}_i$ denotes the unobserved country-specific effects which are assumed to be fixed over time and different across country i and can be correlated with the included variables. The error term ε_{it} is assumed to be independently, distributed across i and over t with mean zero and variance σ^2 (Greene, 2003).

The random effects model assumes that the individual specific constant terms are randomly distributed across countries. The error is country specific and is uncorrelated with the errors of the variables in the model. The model takes the form;

(15) $$\ln FDI_{it} = \alpha + \beta' X_{it} + \mu_i + \upsilon_{it}$$

$\varpi_{it} = \mu_i + \upsilon_{it}$ Where μ_i and υ_{it} are assumed to be independently, distributed across i with mean zero and variance σ_ϕ^2 and μ_i are assumed independent of X_{it} and υ_{it}.

To determine which model specification (13)-(15) is appropriate; poolability test, Breusch-Pagan test and Hausman specification test were carried out.

The poolability test determines if the pooled regression in equation (13) is appropriate by testing the null hypothesis that all individual country and time parameters are equal to parameters of the pooled data model.

(16) H_0: $\beta_1=\beta_2=_{..} \beta_T=\beta$ and $\alpha_0= \alpha_1=\ldots \alpha_T= \alpha$

Rejection of the null hypothesis means that the data cannot be pooled and so the pooled regression is not appropriate. The F statistic was 9.94 (probability=0.00) meaning the pooled regression model is not appropriate.

The Breusch-Pagan test uses OLS residuals to carry out a Lagrange multiplier test for random effects in the model. The null hypothesis is that cross-sectional variance components are zero. Rejection of the null hypothesis means that there are individual random effects in the data. The test had a Chi-Square of 4.42 (Probability= 0.0356) which is significant at 5% indicating that there are individual random effects.

The Hausman test is a confirmatory test for the choice between fixed effect and random effect specifications. The Hausman test is based on the idea that under the null hypothesis of no correlation between country effects and included variables, both OLS in the fixed effects model and GLS in the random effects model are consistent, but OLS is inefficient, whereas under the alternative, OLS is consistent but GLS is not (Greene, 2003). Therefore the two coefficients should not differ systematically. The test question is whether there is significant correlation between unobserved country-specific effects and the included variables. If there is no correlation, then the random effects model is better but if there is such correlation, the GLS estimate from the random effects model would be inconsistent and the fixed effects model would be preferred.

The covariance matrices of the fixed and random effects models are compared and if there is no significant difference between them, then the correlations of the individual effects with the regressors are not significant and the random effect is chosen. If they are different and the null is rejected, then the individual effects are correlated with the regressors, which support the fixed effects model. The test had a Chi-Square of 46.42

(Probability= 0.0033) which is significant at 1% indicating that there is correlation between country effects and included variables implying that the GLS estimator from the random effects model is inconsistent which supports the fixed effects model.

Appendix B

Diagnostic Tests

Panel data models are affected by heteroscedasticity and autocorrelation and these problems need to be handled in order to get consistent and efficient estimates. To test for panel level heteroscedasticty resulting from violation of the constant variance (homoscedasticty) assumption of linear models, the study uses the Likelihood ratio test. The test statistic is has a Chi-square distribution under the null hypothesis of constant error variances. The null is rejected if the estimated Chi-square statistic is more than the tabular Chi-square and we conclude that there is heteroscedasticity. Chi-square statistic for the Likelihood ratio test was 109.21 (probability=0.00).

Autocorrelation refers to the serial correlation of the disturbances across periods. Estimating the model without correcting for autocorrelation leads to inefficient least squares and inferences based on the least square estimates are adversely affected (Greene, 2003). To test for panel level autocorrelation, the study uses the Woodridge test for autocorrelation. The test statistic is an F-statistic with the null of no first-order autocorrelation. The test statistic was 1.076 (probability = 0.3091). Using a significance level of 5%, these results show that there is no first order autocorrelation in model.

Given the presence of heteroscedasticity and since the panels are unbalanced, Feasible Generalized Least Squares (FGLS) was used because it accommodates fixed effects and heteroscedasticity across panels (Stata, 2003; Greene, 2003). FGLS is also appropriate because it can handle time-invariant variables (in this case the dummy variables) that were included in the model (Hsiao, 2006).

Another problem in estimating equation (12) is endogeniety due to the bidirectional nature of foreign direct investment model which means that foreign direct investment is likely to be attracted to countries with higher GDP and also high foreign direct investment may lead to higher country GDP. To examine whether there exists this endogenous relationship between foreign direct investment and GDP the Durbin-Wu-Hausman test (augmented regression test which is referred to as DWH) is conducted by including the residuals of the suspected endogenous right-hand-side variable as a function of all exogenous variables in a regression of the original model. If the included residuals are statistically significant, there is endogeneity between foreign direct investment and the variable in question. The DWH coefficient for GDP was 0.1929(standard error of 0.00632), which represents a t-statistic of 30.54 (P=0.00) which is significant at 1%. Therefore GDP is endogenous. To address this problem the most common procedures used in the literature is the use of Generalized Method of Moments (GMM) as in Baum, *et al.,* (2003), Alonso-Borrego and Arellano (1999), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1997) where a dynamic panel model is estimated. But due the difficulty in using GMM with unbalanced panels and the biases arising from panel size considerations, this study will not use this method. Instead this study follows Chen (1997) by lagging the endogenous variable by k years. The effect of GDP at time t-k is assumed to appear only within period t and is fully completed within that period (Chen, 1997). The relationship between FDI and GDP was investigated for a number of lags but k-1 turned out to be the most appropriate lag.

Appendix C

Table 6: Random effects Estimates of Foreign Direct Investments in Africa with out population variable

Variable definition	Variable	Estimated Coefficients	Z- value	P- value
Gross Domestic Product	LAGDP	0.611*** (0.363)	1.680	0.092
Capital Formation	LCFOM	0.332 (0.350)	0.950	0.343
Inflation Rate	LINFLAT	-0.136* (0.077)	-1.770	0.077
Literacy Rate	LLIT	1.524** (0.685)	2.220	0.026
Exchange Rate	LEXR	0.399*** (0.098)	4.070	0.000
Remoteness	LREM	-2.045 (1.889)	-1.080	0.279
Paved Roads	LROAD	-0.057 (0.236)	-0.240	0.809
Openness	LOPEN	0.144 (0.443)	0.320	0.745
Political Stability	LPOLISTA	-0.479 (0.404)	-1.190	0.236
Central Region	R1	-1.662* (0.921)	-1.800	0.071
Eastern Region	R2	0.099 (0.858)	0.120	0.908
Western Region	R3	-1.261 (0.867)	-1.450	0.146
Northern Region	R4	0.737 (0.762)	0.970	0.333
Constant	CONS	7.180 (13.675)	0.530	0.600
Number Of Observations	216			
Wald Chi-Square	71.09			
Probability	0.000			

Appendix D

Table 7: Random effects Estimates of Foreign Direct Investments in Africa with population variable

Variable definition	Variable	Estimated Coefficients	Z- value	P- value
Gross Domestic Product	LAGDP	0.730*** (0.277)	2.630	0.008
Capital Formation	LCFOM	0.345 (0.313)	1.100	0.271
Inflation Rate	LINFLAT	-0.171** (0.072)	-2.380	0.017
Literacy Rate	LLIT	1.015 (0.520)**	1.950	0.051
Exchange Rate	LEXR	0.197** (0.082)	2.420	0.016
Remoteness	LREM	0.689 (1.634)	0.420	0.673
Paved Roads	LROAD	-0.174 (0.196)	-0.890	0.375
Openness	LOPEN	0.894** (0.395)	2.260	0.024
Population	LPOP	1.268*** (0.209)	6.060	0.000
Political Stability	LPOLISTA	-0.409 (0.359)	-1.140	0.255
Central Region	R1	-0.523 (0.7290	-0.720	0.474
Eastern Region	R2	-1.153* (0.662)	-1.740	0.082
Western Region	R3	-0.296 (0.674)	-0.440	0.661
Northern Region	R4	0.572 (0.652)	0.880	0.380
Constant	CONS	-33.896 (13.619)	-2.490	0.013
Number Of Observations	216			
Wald Chi-Square	132.4			
Probability	0.000			

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